MARCH 20, 1961

American Machinist / Metalworking Manufacturing

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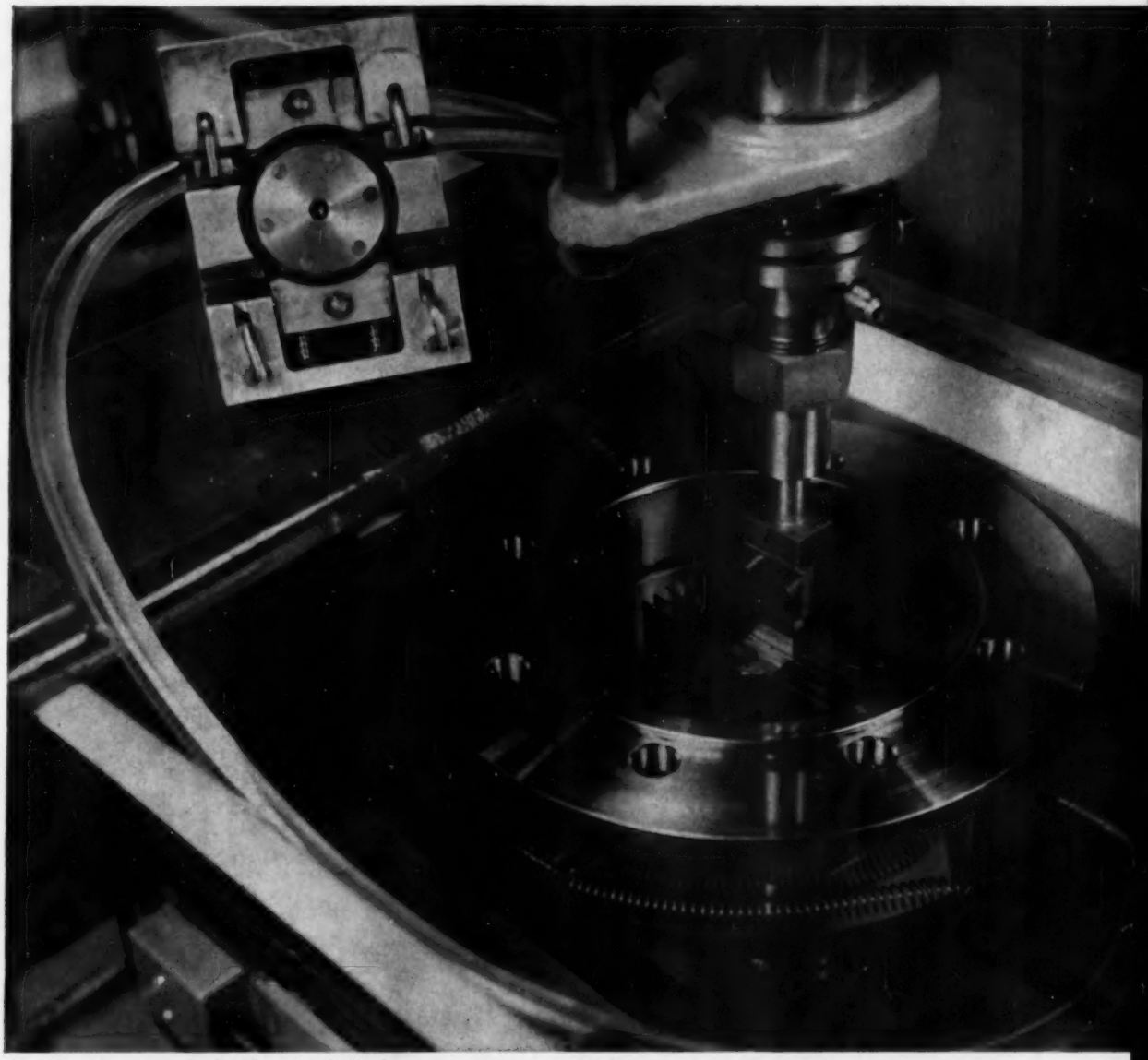

Suction pump speeds electrical discharge machining of slots—see page 142

- **Magnetic forming,** p117
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- **Flame cutting,** p128
- **Turret drilling,** p131

TOOL-TIP GEOMETRY...

Elliptical or true Radius?

by Bruno A. Holmstrom
Chief Tool Engineer
The Heald Machine Company

To view this subject in its proper perspective, it is important to remember that no matter how large, complex or costly a boring or turning machine may be, it's the *tool tip* that does the work of removing metal. And on the proper geometry of this small but all-important part depends the success or failure of the entire machining operation.

One of the essentials of good tool design is the correct clearance angle between the work and tool at point of contact.

When finish cutting straight or tapered bores or O.D.'s, a varying clearance angle may be used, as all cutting is done with the outer tip of the tool where this angle is at the maximum. Here a conventional elliptical-point tool, where the clearance angle decreases on either side of the outer tip, is entirely satisfactory. Such tools can be accurately sharpened with an axis of tool reciprocation that is parallel to the face of the grinding wheel, as shown in Fig. 1.

However, when contour boring or turning spherical or irregular shapes, an entirely different situation occurs. Here, the point of contact on the tool tip varies from point to point on the workpiece, as shown in Fig. 2. If a conventional elliptical-point tool were used, the radius and clearance angle would vary from point to point on the work contour and optimum tool geometry would occur only at one of these locations.

For contour work, it is therefore preferable to use a true-radius tool tip—in which the clearance angle and radius is the same for any point on the cutting edge. To generate such a tip, the axis of tool reciprocation must be tilted with respect to the face of the grinding wheel, and this angle then becomes the constant clearance angle of the tool. This is shown in Fig. 3.

To permit grinding either *true-radius* or *elliptical-point* tools with maximum precision and economy, we developed the Heald Model 4 Tool Sharpening Machine. It is the *only* machine of its type which offers this choice of tool-tip geometry while providing fully automatic tool reciprocation for uniform and repetitive tool tip accuracy.

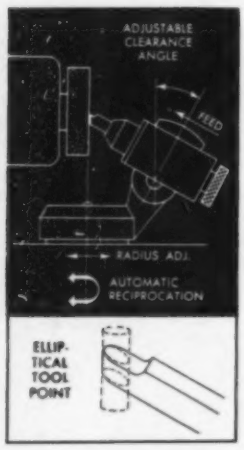


FIG. 1. Elliptical tool point with decreasing clearance angle for conventional straight-line work. Upper sketch shows arrangement of tool sharpening machine.

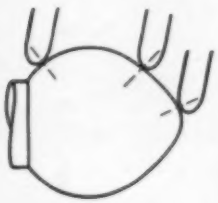


FIG. 2. Sketch showing how contact point of tool varies for different points on a contoured workpiece.

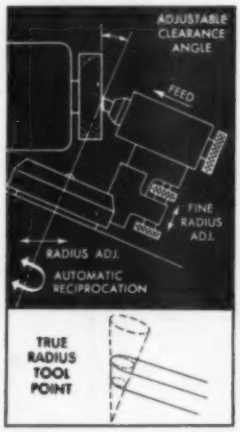


FIG. 3. True-radius tool point with constant clearance angle for contour boring or turning. Upper sketch shows tool sharpening arrangement.

FIG. 4. Heald Model 4 Tool Sharpening Machine arranged for precision grinding of true-radius tool point.

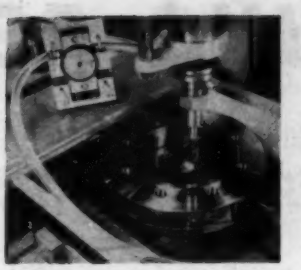
Ask your Heald representative for complete information on the Model 4 Tool Sharpening Machine, or send for Bulletin 2-4-3. **It PAYS to come to Heald.**

THE HEALD MACHINE COMPANY
Subsidiary of The Cincinnati Milling Machine Co.
WORCESTER 6, MASSACHUSETTS

CIRCLE 151 READER SERVICE CARD

COVER:

Suction pump added to Elox EDM machine speeds slot machining at Argonne National Laboratory. See page 142.



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TURN PAGE FOR METALWORKING REPORT——►

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

INSPECTION . . . Electric bearing analyzer continuously records speed and friction losses for sleeve and shaft bearings. Under development by Tann Corp, Detroit, the system is said to be the **first to measure only the torque in test bearings** while electronically eliminating torque and vibration from test equipment. By varying load and speed up to 3500 rpm and 200 lb, engineers can **determine with extreme accuracy the optimum operating conditions for any bearing configuration.** When completed next year, it will also measure shaft deflection, thickness of hydrodynamic oil film, noise, and vibration.

CUTTING . . . Ultrasonic vibrations in coolant boost production in surface grinding. Plants that have field-tested the Ever-Grind attachment from Cavitron Equipment Corp, report that it increases production rates because **wheel runs cool and clean, doesn't load up, and needs considerably fewer dressings.** Also, surface finish is improved. Experts speculate that the principle **may have significant application in the field of form grinding.** For more details, see the article that begins on p124.

MANUFACTURING CONTROL . . . A multi-control system scans up to 300 instruments in a production process, then feeds back corrective instructions. The IBM 1701 combines a digital computer and a data converter that translates instrument readings into computer language. **In quality control, the system could inspect all parts as they come off the assembly line, replacing random checks.** Still another use: The system can evaluate a manufacturing process, indicating modifications to eliminate flaws. Monthly rental ranges from $2600 to $3300. Purchase price: $111,000 to $135,000.

WELDING . . . A new combination of forming and arc welding is producing 6-in.-long cylinders made of 3/16-in. stock at production rates up to 125 per hr, according to National Electric Welding Machines, Bay City, Mich. **A pneumatic clam-shell forming machine wraps the plate** around a mandrel and holds it there while an **automatic CO_2-shielded welder makes the joint.** A typical product: motor cases that are later expanded about 1½ in. to an exact ID.

ASSEMBLY . . . Foolproof magazine supplies assembler with 48 parts in correct sequence. As the 48-compartment storage magazine **automatically indexes one position each heating cycle and reveals the next solder-filled typewriter type piece,** the assembler induction-solders them to type bars. Magazine and induction soldering machine were both developed by T S Precision Engrg Ltd, Brighton, Sussex, England.

FINISHING . . . Ultrasonic "irradiation" takes off micro burrs—those burrs that are too small to be seen but too large to be **tolerated on intricate components. Ultrasonic Systems Inc, Los Angeles soaks parts in ultrasonic irradiation from 2 to 6 hr,** depending on configuration and degree of finish needed. Process will deburr, clean, texture, polish, and create a symmetrical radius on sharp edges.

CUTTING . . . Russians are arc machining cylindrical castings of stainless and high-temperature alloys. **This rough-machining setup resembles a lathe,** except a water-cooled, steel disk replaces the cutting tool. As disk and workpiece rotate (in opposite directions), the arc formed between them melts metal away from the workpiece. **Energy consumption during machining is lower for high-alloy steels** (with low thermal conductivity) than for unalloyed carbon steels. Process (see p000) reportedly increases surface hardness of work.

MATERIALS HANDLING . . . A console control signal routes conveyor-borne parts in a new setup at Control Design & Fabricate, Inc, Farmington, Mich. Here, one or more "elector" and "mimic" consoles are connected to the conveyor network. When a unit passes the elector, the operator punches in a distribution code. This **signals mimic control which then routes the part** to its destination.

ASSEMBLY . . . Socket jam screws, with a clear-through hex socket, may have as few as two full threads in small sizes. Because of this design, **you can get at it from either side with a key wrench.** Some applications for the screw—made in sizes from No. 4 to 1 in. by Holo-Krome Screw Corp of Hartford, Conn—are: joining thin sections, adjusting screw for detent, jam screw for socket screw, device to force a dowel pin.

FORMING . . . A commercial tapping unit can now be built into a progressive die at any station; this saves a second operation. The unit, from Laughter Corp, 319 Leo St, Dayton 1, Ohio, consists of a hydraulic unit with motor, solenoid valves, and precision control. Hinged for easy tap changes, **it operates at up to 75 strokes a min, taps up to 4 threads** in the workpiece. Maximum tap size is ⅜ in.

INSPECTION . . . Zoom optical system gives continuous magnification from 17.5 to 1940X in Bausch & Lomb's new line of DynaZoom microscopes. The optical system, called Micro-Zoom, is said to eliminate image blackout and focus shift within entire range. **Polaroid Land Camera and 35-mm attachments permit photomicrography** directly through eyepiece.

MANUFACTURING CONTROL . . . A "task force" team rides herd on all major projects at the Instrument Div of Lear, Inc. Operating in a staff function, but with line authority, the team keeps close tabs on all phases of a project—from contract go-ahead to completion. **When a project falls behind schedule, the team steps in, rescues it, and sees that delivery dates are met.** Details on p138.

MATERIALS . . . Spiral-wound aluminum foil is the latest addition to container competition. Foil is being wound into tubes as a laminate with an interlayer of fiber board by Anaconda Aluminum. **Frozen juice is first use.** Other frozen foods, as well as oil, grease, paint, and solid components are expected to follow.

Continued on next page

Coming in AM/MM

- *A new cost-cutting tool*
- *Production plants in the Soviet Union*
- *Gages that simplyfy assembly*

METALWORKING REPORT . . .

WELDING . . . A numerically-controlled welder joins tapered products automatically, according to P&H Harnischfeger Corp of Milwaukee. The company's Welding Products Div has developed equipment that is controlled by conventional punched tape. **First applications are on missile skins that taper from** 0.100 in. thick at one end of weld to 0.010 in. at the other end.

FORMING . . . Let the strip itself carry blanks through cupping and sizing. This concept—which won the John Woodman Higgins Redesign Award for Emil Loeffel, tool engineer at H K Metalcraft Mfg Co—**saves metal normally used for feed fingers attached to strip and blank.** Details on this die, which sharply cuts the cost of making an item normally considered a screw machine part, are on p126.

MATERIALS . . . Resistance to 18,000 F plasma "flame" for 25 sec is one remarkable property of Pluton, a new all-organic fabric developed by Minnesota Mining and Manufacturing Corp. Tested samples of only one lb per sq yd were compared with chemically treated asbestos weighing 4½ lb per sq yd, which disintegrated in six sec. Pluton fiber is an **organic molecular chain containing carbon, hydrogen, oxygen, and nitrogen**—but no free carbon, graphitic or otherwise.

MANUFACTURING CONTROL . . . Management's creative ideas have saved $7-million in the last four years for the Arma Div of American Bosch-Arma, Garden City, NY. In the system, called CIP (for Cost-Improvement Program), **management personnel submit forms that recommend improvements in manufacturing, design, purchasing, and the like.** Each recommendation receives an exhaustive analysis by an objective group. A Special Report about this cost-cutting program is scheduled for our next issue.

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NEW CINCINNATI 28" Vertical HYDRO-TEL

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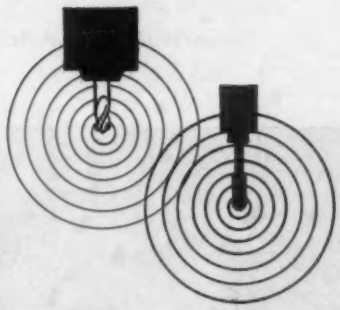

According to national surveys, metalworking shops everywhere have a lot of catching up to do . . . in methods and modern equipment as well. In areas of heavy duty milling and die sinking, new CINCINNATI 28" Vertical Hydro-Tels give you the opportunity to catch up fast.

Cutters now can be easily changed within seconds. Cincinnati's exclusive Arbor-Loc spindle nose, a standard equipment item, gets credit for this advantage. The new Hydro-Tels give you a choice of six ranges of spindle speeds, in three horsepower ratings which are 50% to 100% greater than before. Slideways and all critical bearings are automatically lubricated to assure long life and instant feed response. In addition, vertical headways are hardened and ground.

These new machines are more adaptable to specialized types of milling. They may be equipped with smooth, continuous path automatic depth control for die sinking . . . 360° automatic profiling, with or without auxiliary manual control . . . combination automatic depth control and 360° profiling . . . automatic cycles with pickfeed, for automatically milling entire die forms . . . many other types of equipment, attachments and accessories.

You name it; the new CINCINNATI 28" Vertical Hydro-Tel can do it better and at a much lower cost than thousands of machines now on the job. More reasons why you should modernize with these new milling machines are outlined on the next two pages. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

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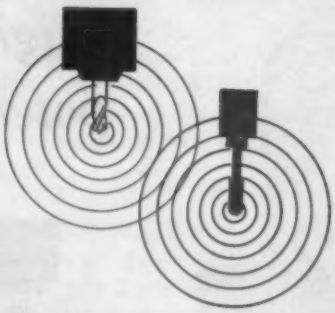
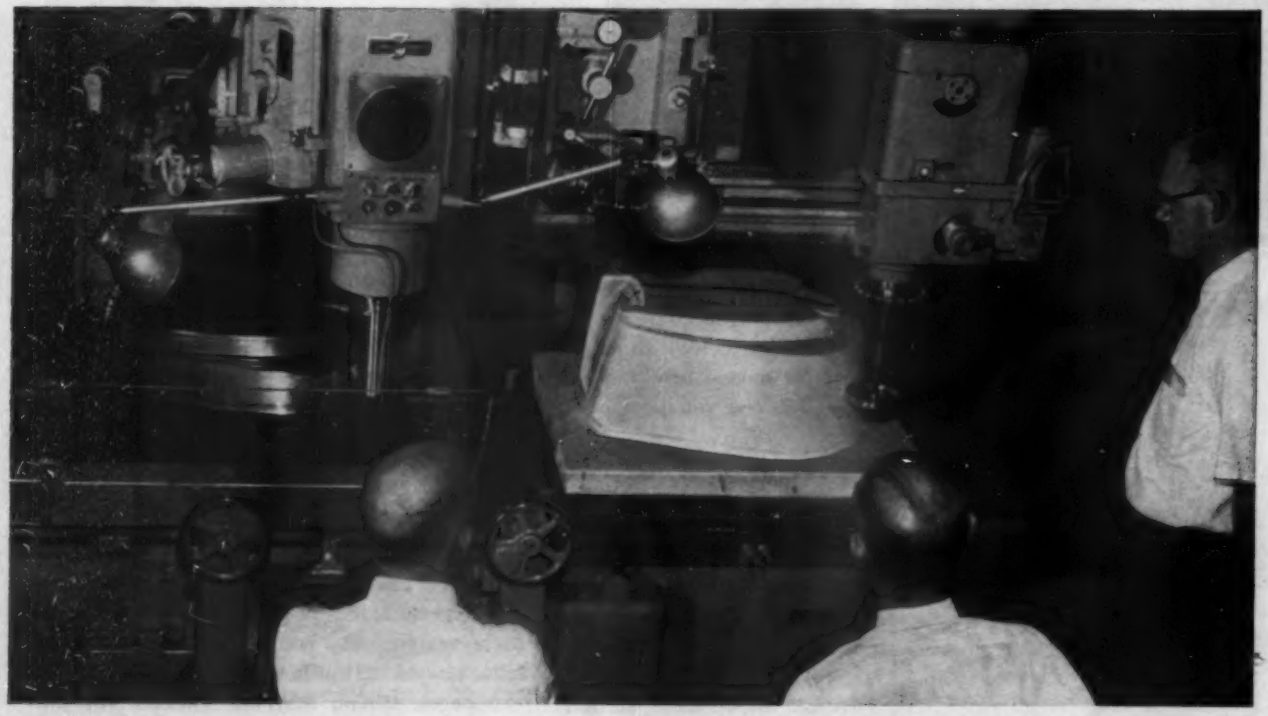


are More Powerful, More Adaptable



Automatically milling a core mold for reinforced plastic shrouds is the attraction on this new CINCINNATI 28" Vertical Hydro-Tel.

KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES • CUTTER AND TOOL GRINDERS •

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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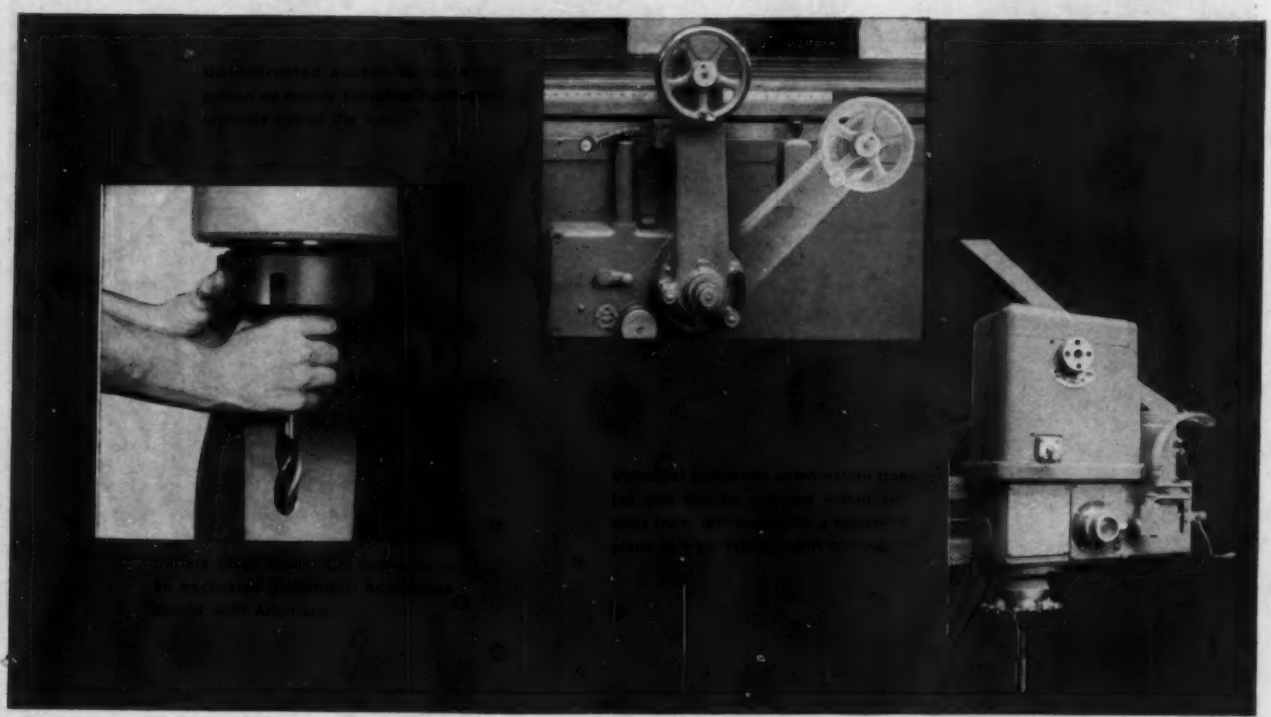
- **Infinitely variable power feeds** for table and cross slide, and for vertical head if desired.
- **Single lever** engages feed and rapid traverse to table, either direction. Similar convenience of lever control for cross slide.
- **Maintenance simplified** with removable hydraulic oil tank on which pumps are mounted.
- **Independent feeds** to table, cross slide, and vertical head; can be individually adjusted to suit the job.
- **Table and crossways protected** by curtain type covers.
- **Unobstructed access** to table top at front of machine quickly established through swivel mounted hand control brackets.

May we give you complete information? Ask for new Catalog No. M-2165. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.** *Telephone RE 1-2121.*



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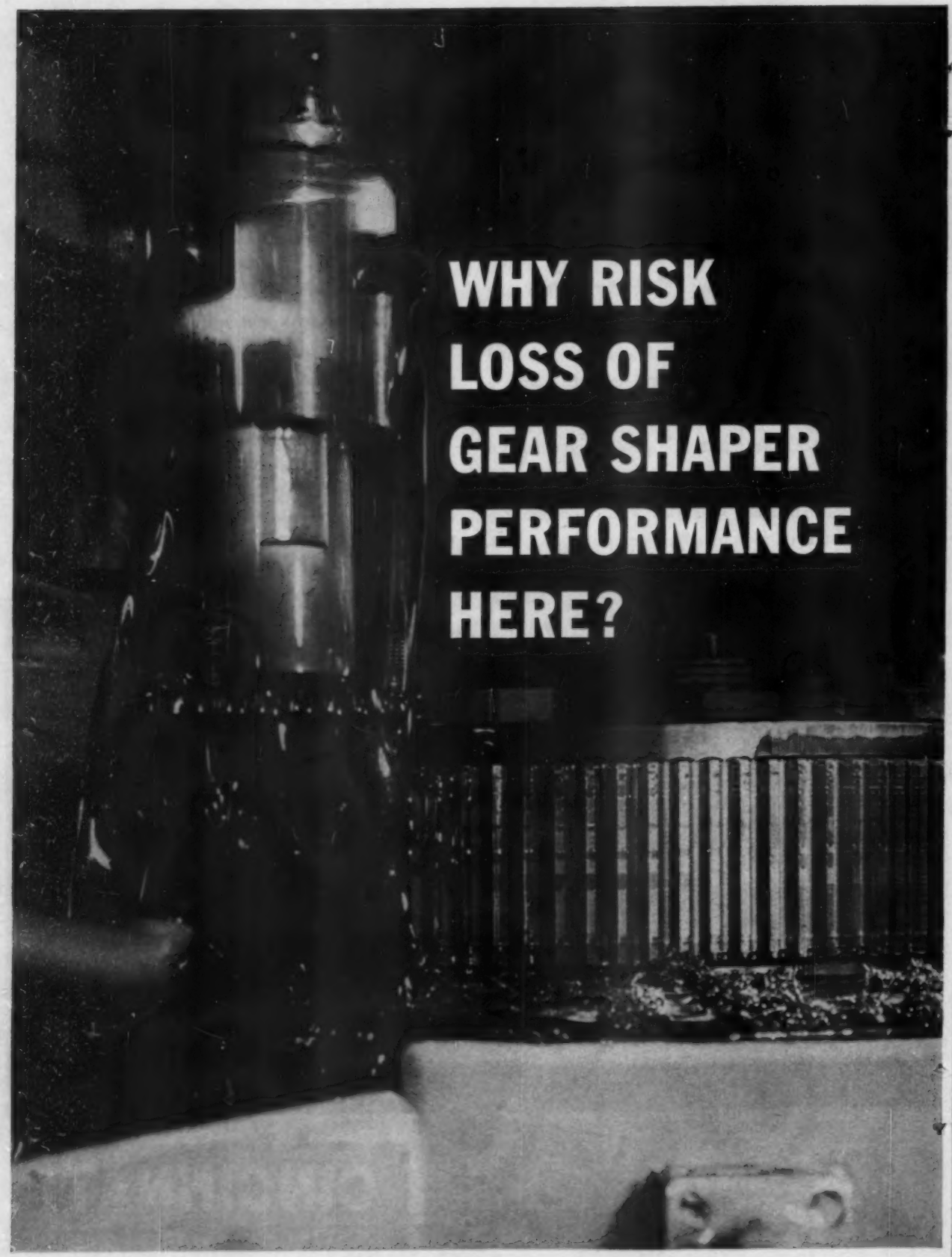
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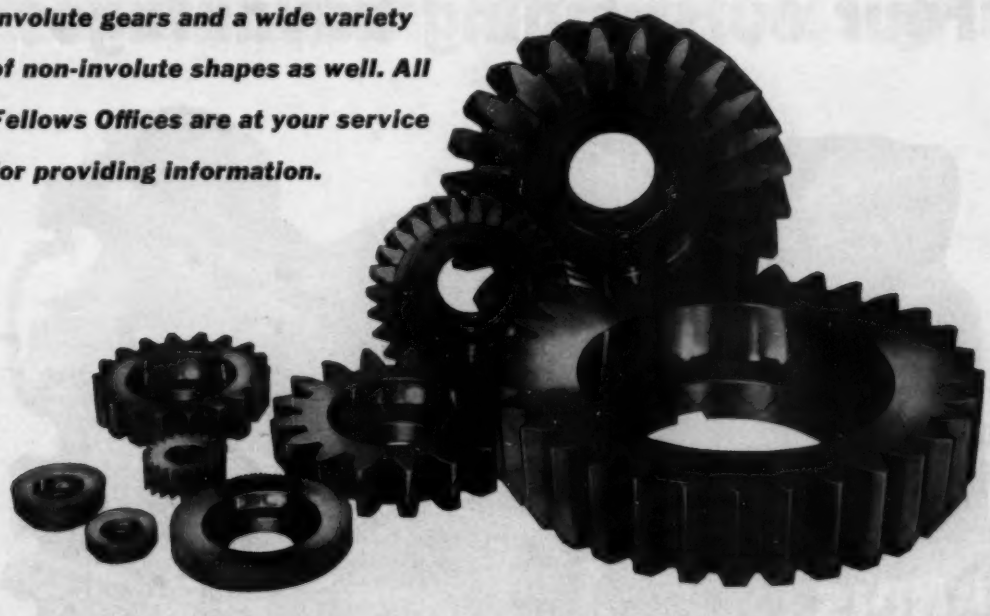

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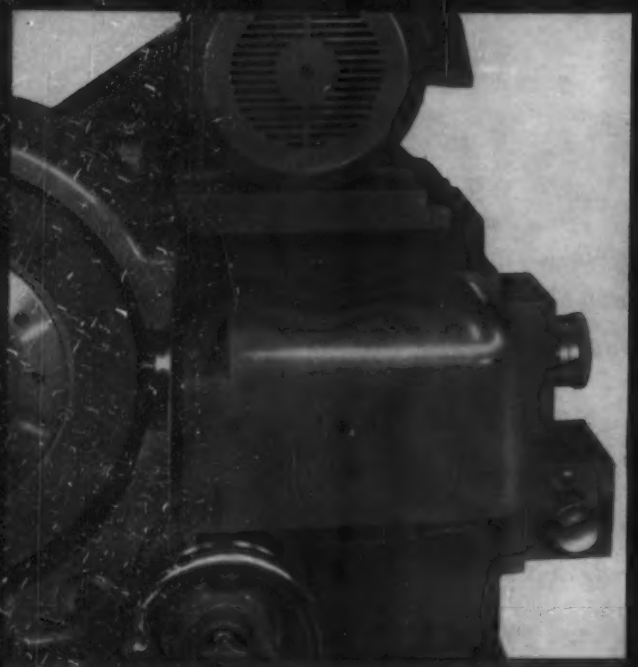
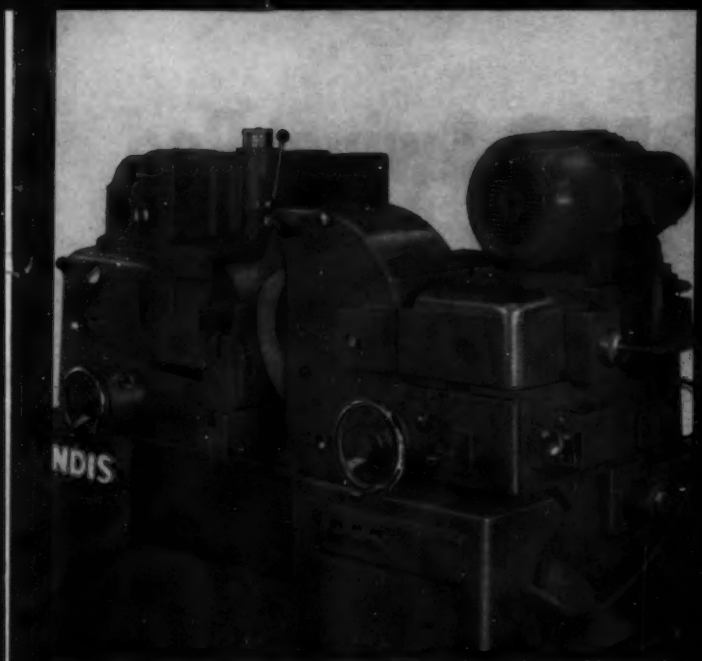


New dressing accuracy . . . Landis Truform dresser with preloaded ball slides, gives exact duplication of the profile on the wheel.

Faster grinding cycles . . . New and exclusive Landis Lockspeed drive for regulating wheel gives quicker sparkout and rounder work.

Four outstanding advantages of



Greater machine stability . . . surface plate ribbing of cast bed maintains perfect alignment of ways for both wheelheads.

Close tolerances . . . work rest solidly mounted on bed with support directly to the base for heavy stock removal without loss of accuracy.

the all NEW Landis centerless grinder

This completely new 12R machine is the finest centerless grinder available anywhere in the world. It will grind parts at a faster rate and to even closer tolerances than was possible before.

LANDIS

world leader in precision grinders

LANDIS TOOL COMPANY, WAYNESBORO, PA.

New ARMSTRONG Swivel Pad can't come off

Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

Here's Why it's STRONGER . . .

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer —yet the pad is free to swivel through an arc of approximately 40°.

Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

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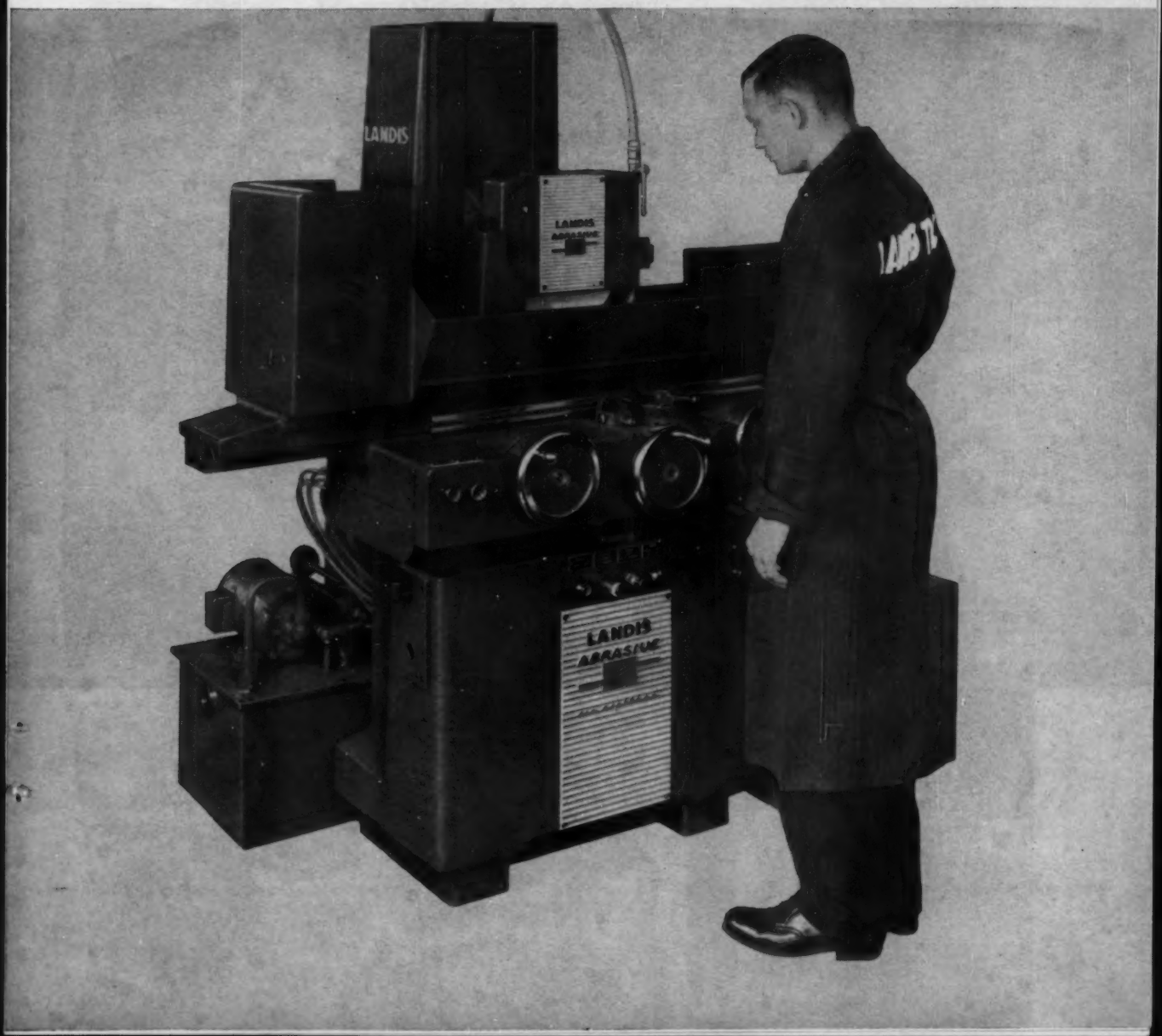
NEW Landis 6″ x 18″ surface grinder with hydraulic crossfeed and table traverse . . . features simple handwheel movement to change from hydraulic to manual operation

brief specifications:

Work surface	6″ x 18″
Table traverse	21″
Saddle movement	6¾″
Vertical capacity (under 7″ wheel)	14½″
(under 12″ wheel)	12″
Grinding wheels	7″ or 12″
Direct spindle drive motor	7″ wheel—1 hp
	12″ wheel—2 hp

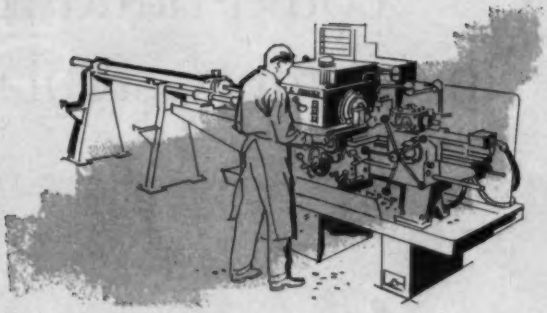
Power elevation of wheelhead available at extra cost

LANDIS



Speed preselection and change, brake and neutral (free spindle) all become an easy, one-hand operation. To preselect, rotate handle; to engage new speed instantly, move it up or down. Direct reading dial gives you surface speed for each diameter and rpm; the numbered clips tell you where to find speeds and their order of use.

THE OPERATOR'S JOB
IS EASIER THAN EVER WITH...



Warner & Swasey's new, faster handling No. 3 Turret Lathe

Unique automatic headstock and the exclusive single lever speed Preselector reduce headstock handling to an absolute minimum... adding the Electro-Cycle® attachment *eliminates it completely.*

The Electro-Cycle attachment (optional) eliminates all headstock handling. Spindle start, stop, reverse, and speed selection are all preset on this setup panel and actuated electrically by index of the hexagon turret. This permits the operator to disregard all spindle control functions, leaving him free to develop his best operating rhythm for efficient, fast-cycle work.

The new eight speed (16 with a two-speed motor) all-hydraulic automatic headstock gives you more speeds in a wider range—from 45 to 2262 rpm—for maximum cutting efficiency in all materials.

Instant speed changes throughout the full range are made possible through exclusive Warner & Swasey designed direct-acting hydraulic clutches (which never need adjustment) in combination with a constant mesh, helical gear train. Time loss for gear shifting in conventional headstocks is eliminated.

Direct mounted motors not only assure full power at the spindle nose, but also eliminate motor-drive maintenance problems.

For the complete story on the production advantages of the new No. 3 Turret Lathe, call your Warner & Swasey Field Engineer, or write direct to Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 164 READER SERVICE CARD

What else but sheet steel could build this new safety stepladder?

for Strength ... Economy ... Versatility

Steel

Stand on the platform, face in any direction, and you feel perfectly safe with this new Rid-Jid "Lifetime" Stepladder. What else but sheets of steel could build a ladder so strong and yet so light? Even the 7½-ft model weighs just 26 lb.

Made by The J. R. Clark Company, Spring Park, Minnesota, the ingenious Rid-Jid "Lifetime" ladder was designed almost entirely of sheet steel for the last word in safety, comfort, and convenience. Its special finish provides all-weather durability; rubber "shoes" give it sure footing even on slippery floors. Like other products in the Rid-Jid line, this ladder has the quality and the muscle that only sheets of *steel* can give.

For many years Bethlehem has furnished blue-ribbon steel sheets to manufacturers of quality products, including The J. R. Clark Company. We can meet your needs with a wide range of sizes, grades, tempers, and surface finishes. Hot-rolled, cold-rolled, galvanized, galvannealed. And we'll gladly pitch in with metallurgical assistance. Just get in touch with our nearest sales office.

BETHLEHEM STEEL COMPANY, Bethlehem, Pa. *Export Sales:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

NEW!

RED RING PRECISION GEAR HONER

Smaller

More Compact

Lower Cost

FULLY AUTOMATIC
SEMI-AUTOMATIC
MANUAL LOADING

Your choice of 4 Honing Methods

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING,
GEAR HONING AND ELLIPTOID

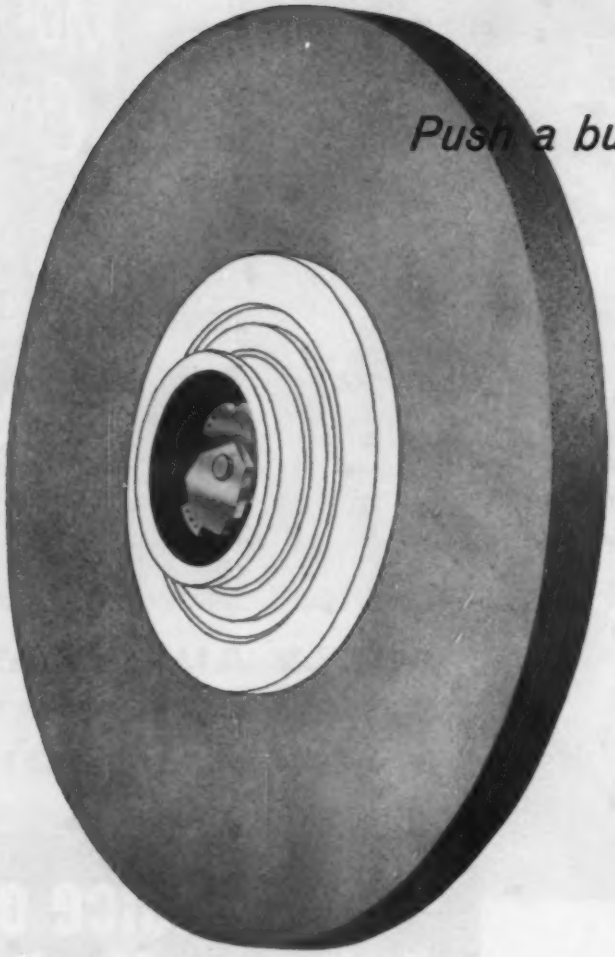
NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

A. Unbalance. Badly out of balance wheel is shown in grinding position on the NORTON Balancer. Pendulum weights are locked in balance correcting position for wheel previously in use. Heavy spot, shown by yellow area, tends to displace center line of wheel spindle from normal center of rotation.

Push a button to balance

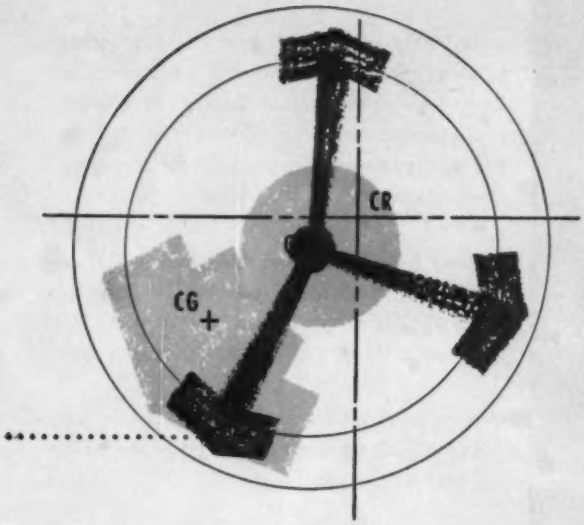


B. The Button Is Pushed. Wheel adapter assembly moves to soft spring suspension. Assembly tries to rotate about center of gravity. Centrifugal force acting outwards from center of rotation causes pendulum weights to move away from heavy spot, as shown.

C. Balanced in 5 Seconds. Pendulum weights have moved to the correct balancing position opposite the heavy spot. Center of gravity, center line and center of rotation are now common as shown. Weights lock and wheel adapter assembly returns to grinding position.

Unusual simplicity of the new NORTON Automatic Wheel Balancer introduces new advantages to unusual grinding operations. The wheel spindle and bearings are never released from carefully fitted housing. Balancing action is developed by slight release of only the wheel assembly from nose of spindle, permitting the assembly to be carried while balancing on a floating spring shaft. Three pendulum type balancing weights give maximum sensitivity to positioning forces. Wheel assembly and balancing weights are clamped and released automatically. Loosening a single spanner nut enables quick wheel changes. Safety interlock prevents operation of mechanism during grinding.

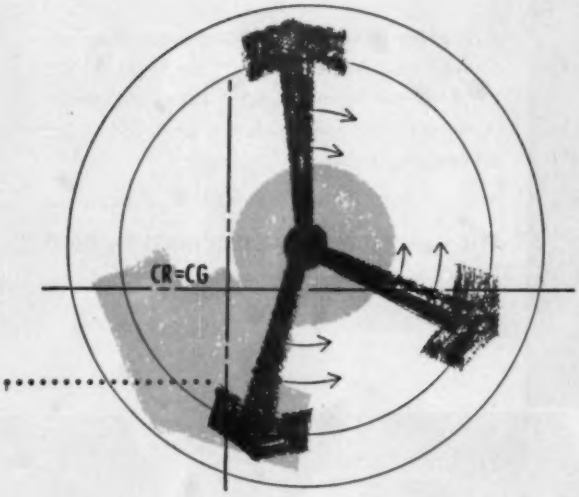
NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

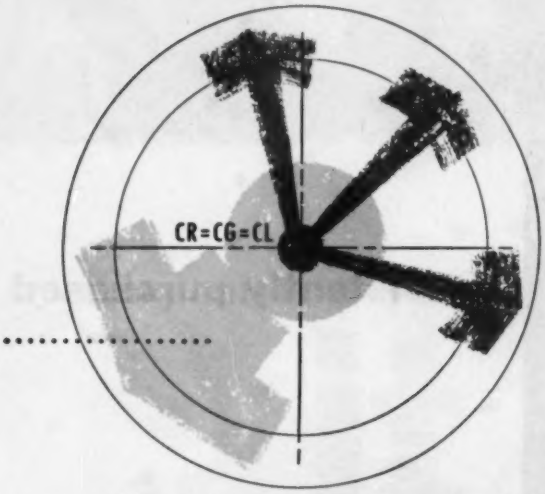


CG = Center of Gravity
CL = Center Line of Wheel Spindle
CR = Normal Center of Rotation

grinding wheels precisely...

automatically in 5 seconds





New and optional, the NORTON Automatic Wheel Balancer simplifies an extra operation for extreme precision grinding.

Engineered for ruggedness and high precision, NORTON cylindrical grinders have long been recognized for producing completely satisfactory results without wheel balancing — on or off the machine.

That holds good for all but a very small minority of grinding jobs calling for the absolute extreme in precision grinding. It is for such special requirements that the NORTON Automatic Wheel Balancer is designed.

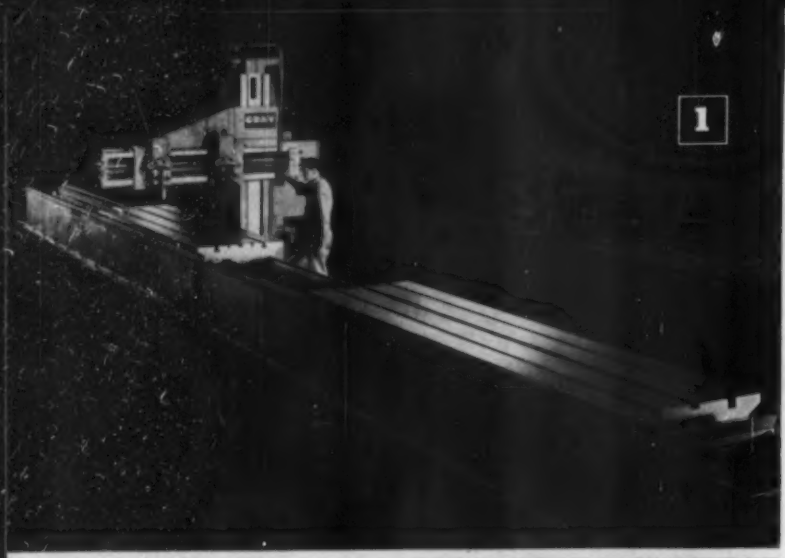
That is why it is optional on most NORTON cylindrical grinders — and that is how it teams up to produce more positive precision than has ever been obtainable with previous wheel balancing methods.

Read the diagrammed descriptions shown here. See how simply, surely and swiftly the NORTON Automatic Wheel Balancer brings new advantages to wheel balancing for maximum precision grinding. For further details, see your Norton man, a Trained Grinding Engineer. Or write to NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. *District Offices:* Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

NORTON
MACHINE TOOLS

75 years of . . . Making better products . . .
to make your products better

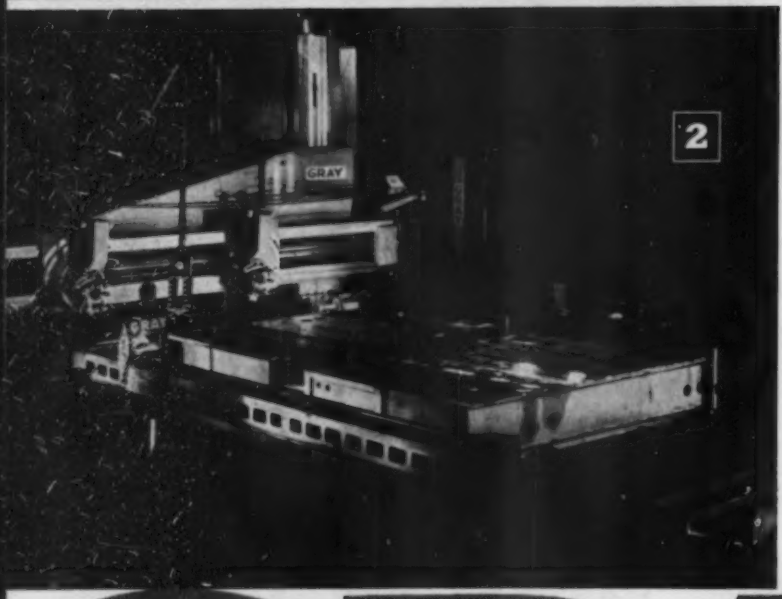
MACHINE TOOL DIVISION: Grinding and Lapping Machines — G & E DIVISION: Shapers • Gear Cutting Machines • Gear Induction Hardeners



1

These GRAY machines feature simplified operation, rugged dependability and great precision. Their high speed, power packed performance removes metal faster and more economically. They pay for themselves by increasing your production, lowering operating costs, reducing downtime.

1. Gray flying scot planer. Most economical universal high speed planer ever built ▪ Basic machine 30" x 6' ▪ Table speed range 30-300 F.P.M. ▪ Model shown is 42" x 28' with duplex table.



2

2. Gray universal planer. Size 48" x 14' ▪ Cuts both ways, out performs a milling machine on flat surfaces with less tool cost.

3. Gray milling machine—planer type. Size 48" x 48" x 16' ▪ Has 10" quill, 50 H.P. non-swiveling rail head ▪ Width between housing 61" ▪ Phase I Space-setter visually shows where you are.

4. Gray horizontal boring, drilling, milling machine. Has 6" dia. nitralloy bar, 60" bar travel ▪ 72" vertical head travel ▪ 50 H.P. spindle motor ▪ Phase III Space-setter, point to point positioning on two axis, runway and column.

Specific bulletins available on all machines on request from

THE G. A. GRAY CO. / CINCINNATI 7 / OHIO

GRAY

3

consistently purchased

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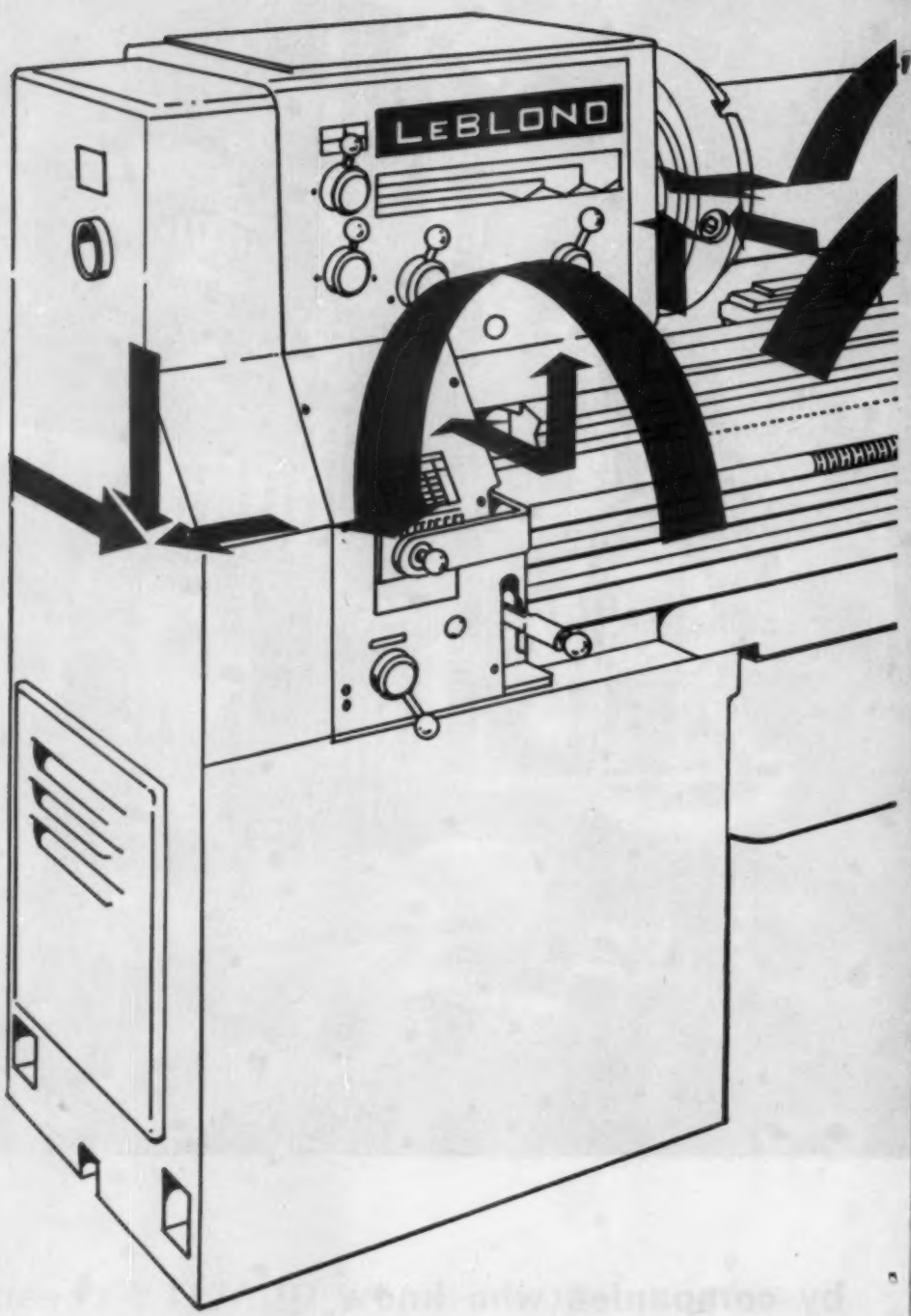
by companies who know QUALITY doesn't cost

it pays!

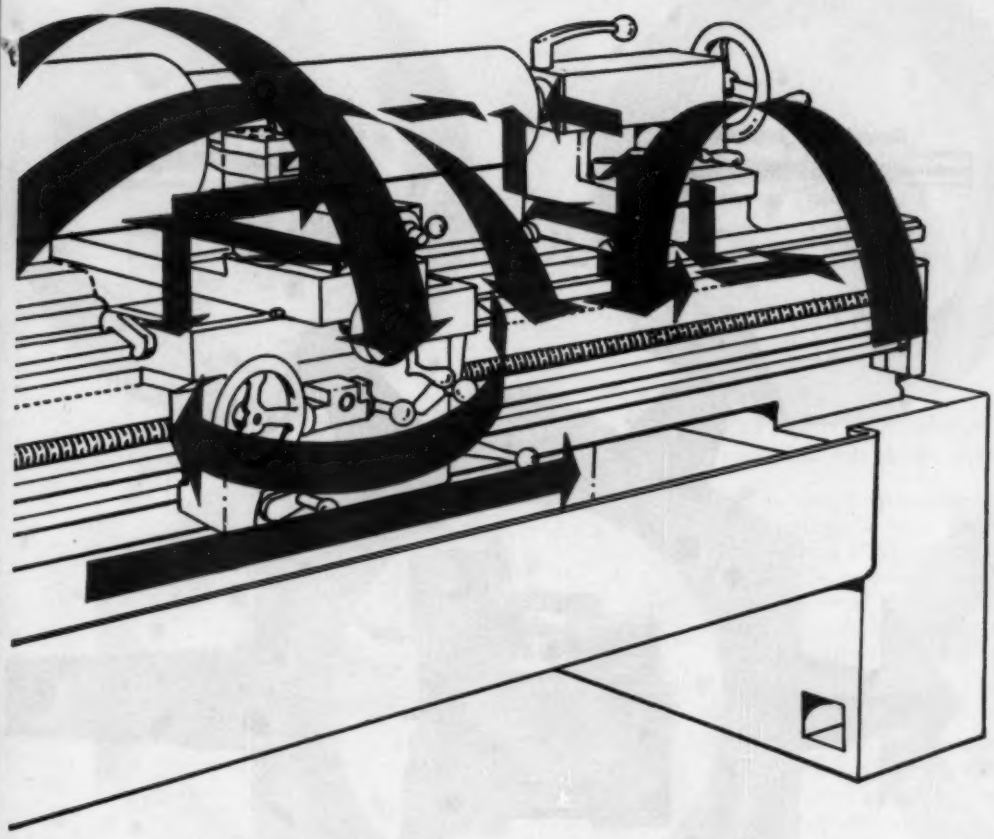
CIRCLE 170 READER SERVICE CARD



The arrows illustrate the forces every lathe has to cope with: Twisting and bending moments in the bed, carriage and tailstock. Thrust and radial forces in the headstock and quick-change box. Hundreds of reactions to the forces created by cutting—all working to upset accuracy by "give" and by wear.

Although most lathes look alike, there's a world of difference in their design and construction—in their ability to resist the forces of cutting over many years. It's this ability that determines how heavy a cut they will take, their long-time accuracy and how much maintenance they will need.

In the new Regal bulletins you will see how well Regals meet the challenge of these forces.



The Inside Story of LeBlond Regal-Lathes

Must Reading for Lathe Users:

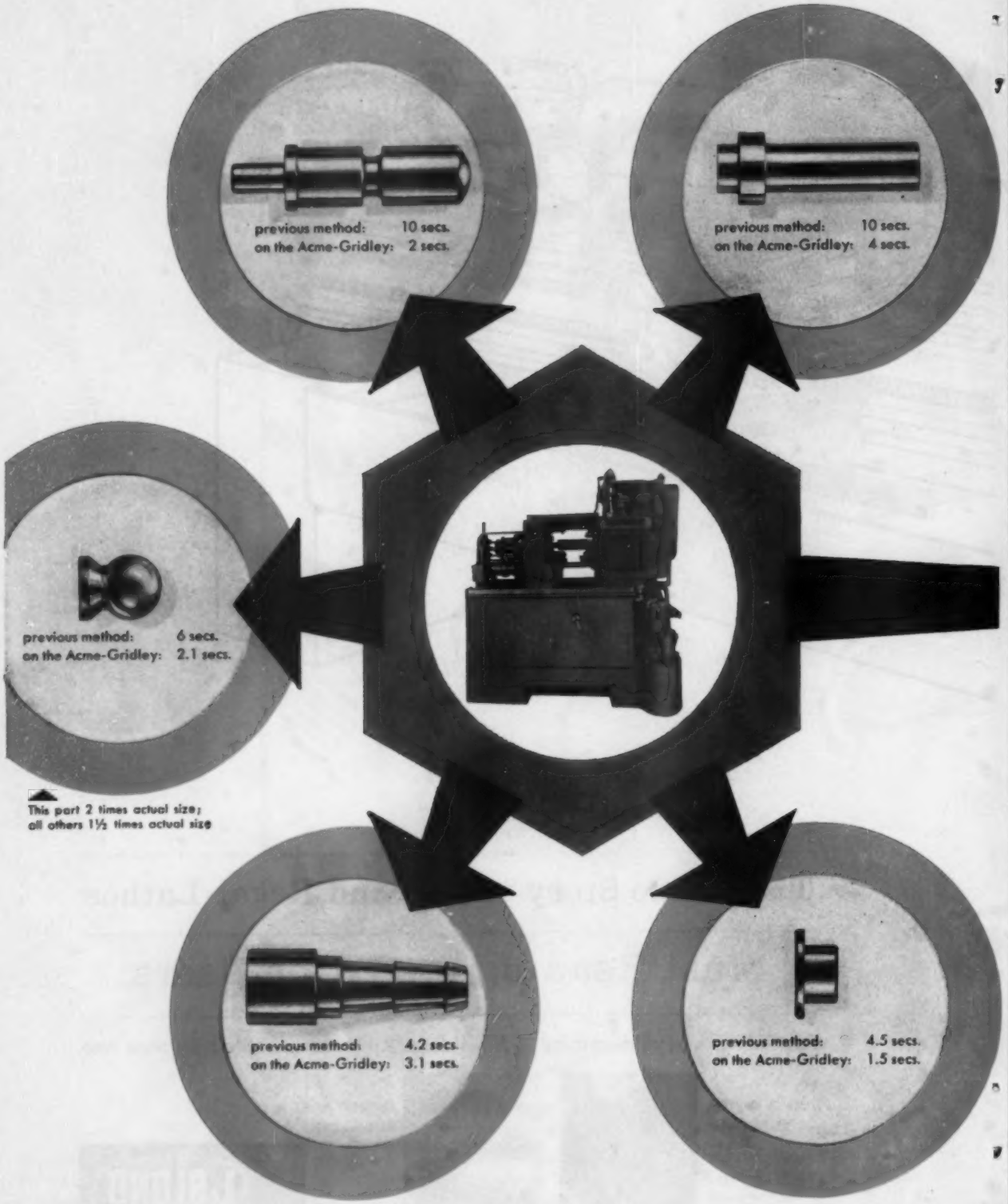
Two NEW bulletins describing 15 NEW Regal Lathes models. Write for them now.

Bulletin R-215A
13-15-17-19″
Regals

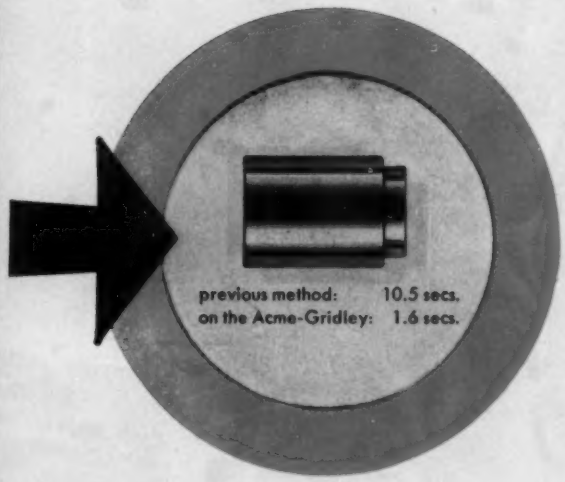
Bulletin R-206A
21″ and 24″
Regals

LeBLOND of Cincinnati

The R. K. LeBlond Machine Tool Company • Madison at Edwards Road, Cincinnati 8, Ohio


previous method: 10 secs.
on the Acme-Gridley: 2 secs.
previous method: 10 secs.
on the Acme-Gridley: 4 secs.
previous method: 6 secs.
on the Acme-Gridley: 2.1 secs.
This part 2 times actual size;
all others 1½ times actual size
previous method: 4.2 secs.
on the Acme-Gridley: 3.1 secs.
previous method: 4.5 secs.
on the Acme-Gridley: 1.5 secs.

ACME-GRIDLEYS SLASH AVERAGE MACHINE TIME 68%...

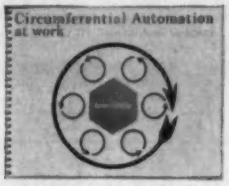


Pay off in profitable new business for screw machine job shop...

Before installing three Acme-Gridley 7/16" RA-6 Spindle Automatics, Carleton Screw Products Co. of Minneapolis found it difficult to keep pace with the demand for greater precision and quality required by current manufacturing standards. Consequently, high costs resulting from slow production methods made Carleton less competitive on short run, small part jobs.

With Acme-Gridleys, it's a different story. Short run, small part jobs are Carleton's bread and butter. The Acme-Gridleys cut average machine time 68% and always produce precision parts that surpass customer specs . . . giving a big boost to Carleton's "repeat order" business.

The 7/16" was *designed* for top economy in the mass production of miniature and sub-miniature parts. It's compact, rugged and has the versatility to handle an amazing variety of jobs. In your shop . . . for years to come . . . it will pay off in lower costs and higher earnings.



The number of *different* jobs that can be set up on any Acme-Gridley amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64 page bulletin called "Circumferential Automation at Work". For your free copy, call, write or wire.

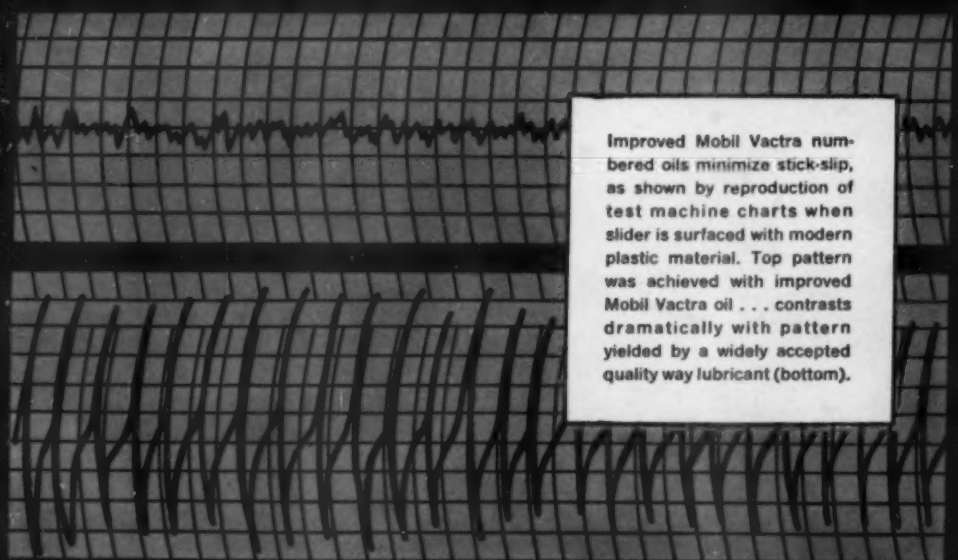
National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

NOW! WAY LUBRICANTS WITH ALL SIX

Stick-slip tester developed by Mobil's research laboratories closely simulates operating conditions of today's machine tools . . . records stick-slip electronically as weighted slider is pulled across lubricated cast iron bed.



Improved Mobil Vactra numbered oils minimize stick-slip, as shown by reproduction of test machine charts when slider is surfaced with modern plastic material. Top pattern was achieved with improved Mobil Vactra oil . . . contrasts dramatically with pattern yielded by a widely accepted quality way lubricant (bottom).

QUALITIES REQUIRED BY TODAY'S MACHINE TOOLS!

IMPROVED MOBIL VACTRA Nos. 1·2·3·4

Excellent for all way systems, all way surfaces, all operating conditions!

To meet the diverse requirements of today's complex machine tools, way lubricants must function effectively under a variety of operating conditions . . . must possess not one or two, but *six* important capabilities.

Now you can get all six—with Improved Mobil Vactra® oils Nos. 1-4, inclusive!

These improved Mobil Vactra oils provide these advantages: • Minimum stick-slip on all types of ways—steel, cast iron or plastic. • Control of table "float" through correct viscosity—without risk of film failure and wear. • Protection against way scoring through controlled EP qualities. • Prevention of lubricant filter clogging. • Protection against rust and corrosion. • Stability under all normal operating conditions.

Improved Mobil Vactra oils Nos. 1-4 offer these benefits:

- **Increased Machine Availability,** because less downtime is required for adjustments...especially significant with today's high overhead and burden rates.
- **Fewer Rejects,** through greater precision and better finishes . . . vitally important with today's closer tolerances and the high cost of finished pieces.
- **Minimum Maintenance Costs,** through effective protection of critical way surfaces.

Available in four viscosities, Improved Mobil Vactra numbered oils permit the selection of a grade exactly suited to any critical operating condition. For complete details, call your Mobil Representative or use the coupon below.

Mobil

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150 East 42nd Street
New York 17, N. Y.

Mobil Oil Company
Room 2057-A
150 East 42nd Street
New York 17, N. Y.

Gentlemen: I am interested in using Mobil Vactra Nos. 1-4 to help alleviate way lubrication problems at my plant.

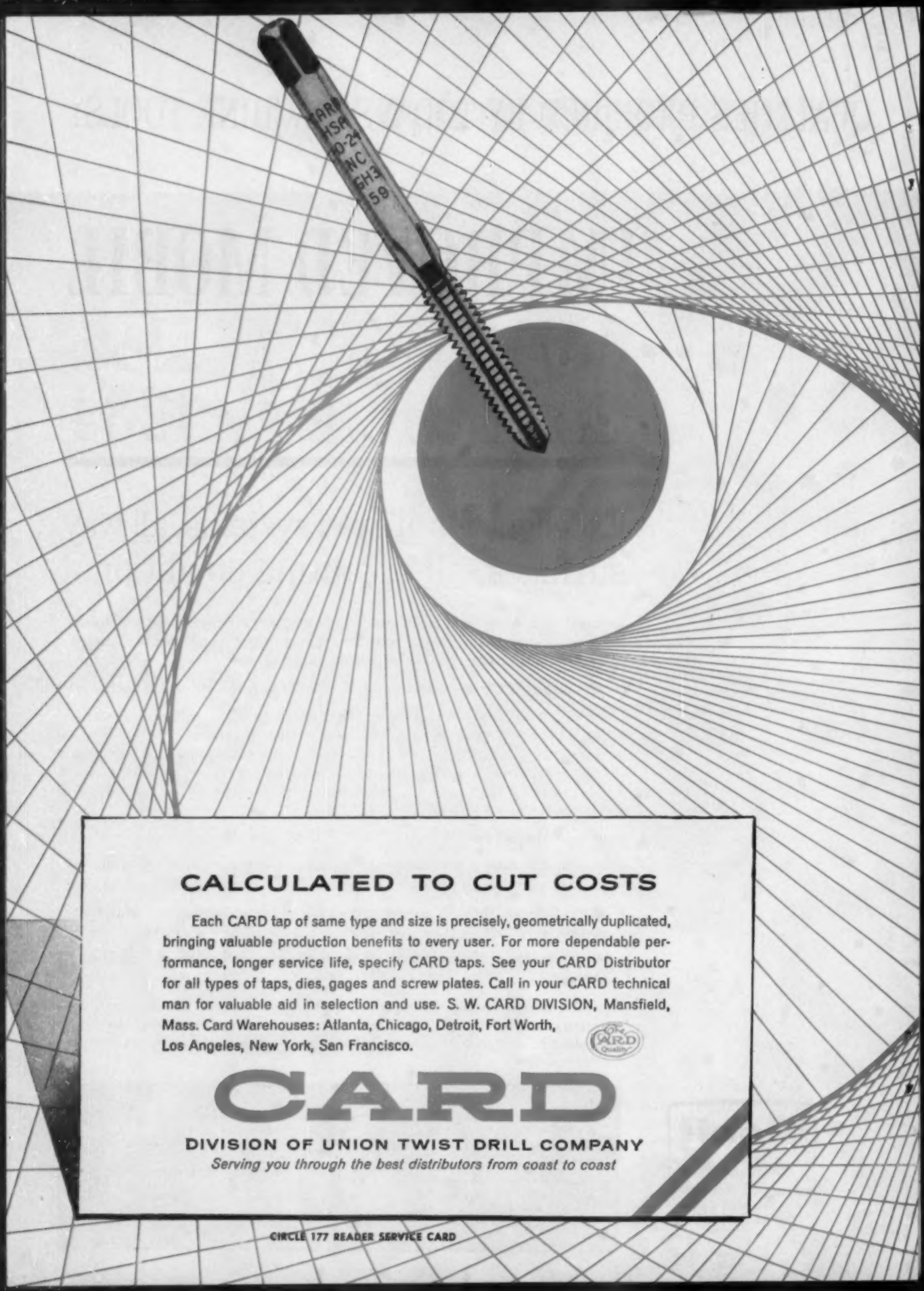
Name_____

Position_____

Company_____

Address_____

City_____ State_____



CALCULATED TO CUT COSTS

Each CARD tap of same type and size is precisely, geometrically duplicated, bringing valuable production benefits to every user. For more dependable performance, longer service life, specify CARD taps. See your CARD Distributor for all types of taps, dies, gages and screw plates. Call in your CARD technical man for valuable aid in selection and use. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

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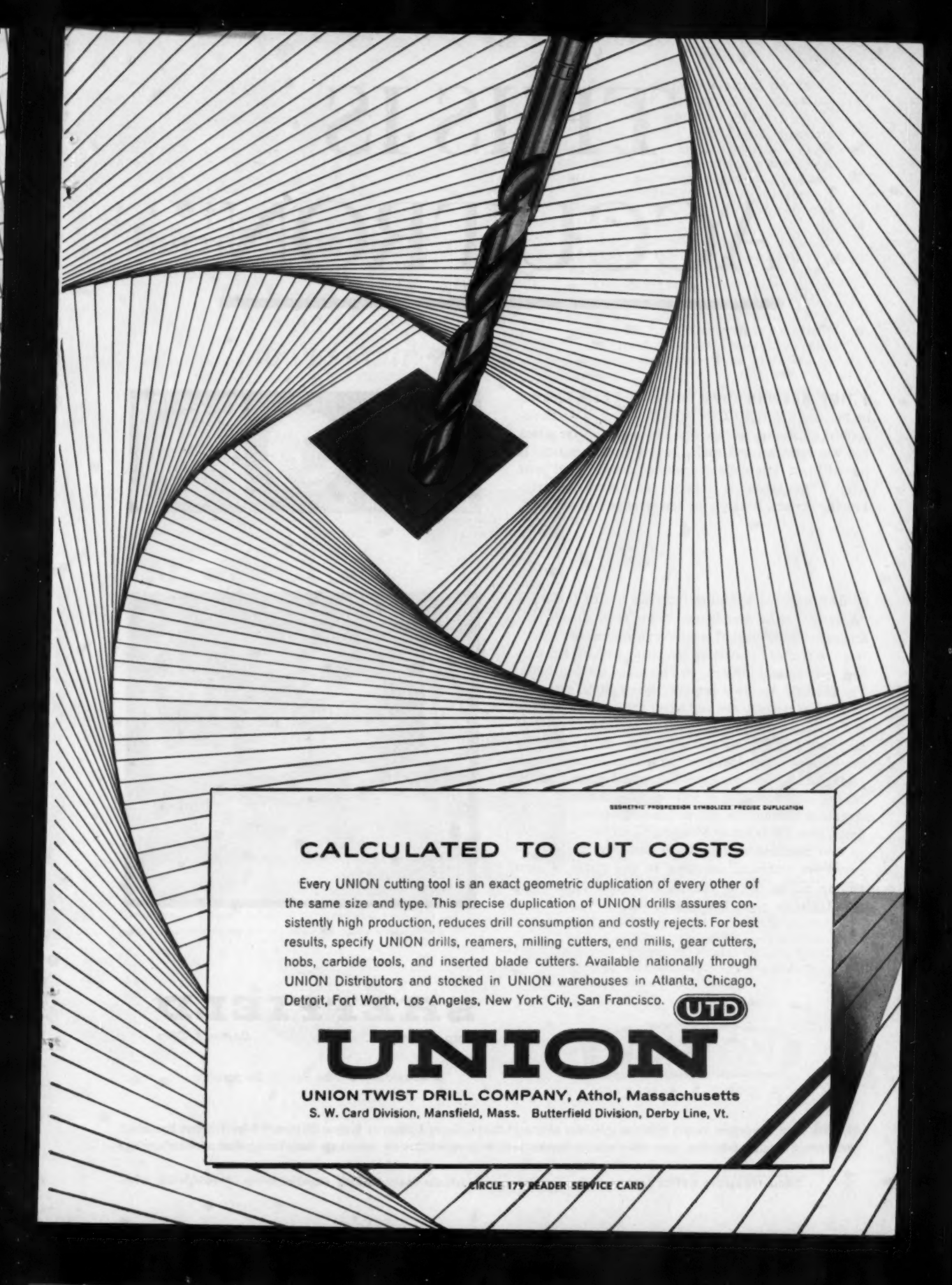
DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

CIRCLE 177 READER SERVICE CARD



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

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Every UNION cutting tool is an exact geometric duplication of every other of the same size and type. This precise duplication of UNION drills assures consistently high production, reduces drill consumption and costly rejects. For best results, specify UNION drills, reamers, milling cutters, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, San Francisco.

UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

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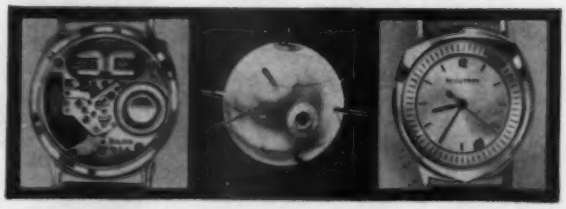
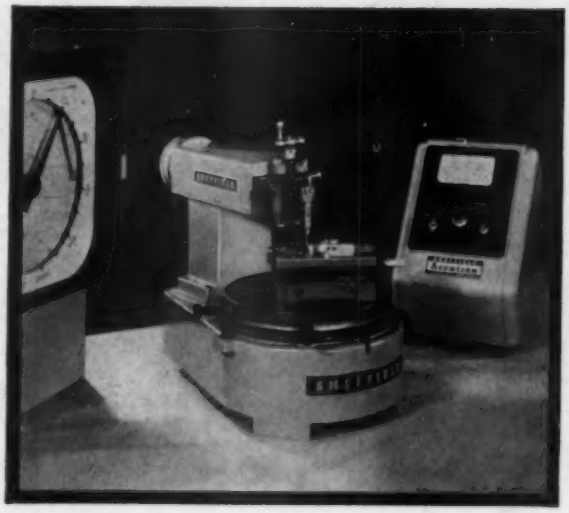
THIS IS ACCUTRON†®

† TIME-KEEPING Great interest has been focused on the new Bulova ACCUTRON timepiece, a watch described by Bulova as "the first instrument of the space age you can wear and use! . . . It doesn't even tick. It hums! First timepiece guaranteed accurate on your wrist." "Accutron" is Bulova's trademark for timekeeping devices. It stands for new standards of accuracy.



® GAGING We welcome Bulova's use of the word "Accutron" as a compliment to the term already distinguished in the field of precision measurement. "Accutron," a Sheffield trademark for gaging devices, has long been a symbol of unquestioned accuracy and reliability. The Sheffield Accutron amplifier, for example, can show dimensions down to two and a half millionths of an inch, and is readily adaptable to an almost unlimited range of electronic gaging heads and tooling, for checking almost any dimension, shape, or relationship. Feathertouch gaging heads (with pressures as low as 5 grams) permit reliable measurements of soft or easily distorted parts. Accutron instruments are in constant service in Sheffield's own Eli Whitney Metrology Laboratory.

Your Sheffield representative can give you prompt competent technical assistance in any phase of your gaging needs. Write for the Sheffield catalog on ACCUTRON gages and accessories.



The **SHEFFIELD** *Corporation* *Dayton 1, Ohio*

A subsidiary of The Bendix Corporation

Inspection Gages, Dimensional Control Instruments, Machine Controls, Automatic Gaging & Assembly Systems, Measuray® X-Ray Thickness Measuring, Crushtrue® & Multiform® Grinders, Cavitron® Ultrasonic Machine Tools, Press-Pacer® Transfer Units, Large Dies, Tooling, Contract Manufacturing.

Barrel finishing is best finishing

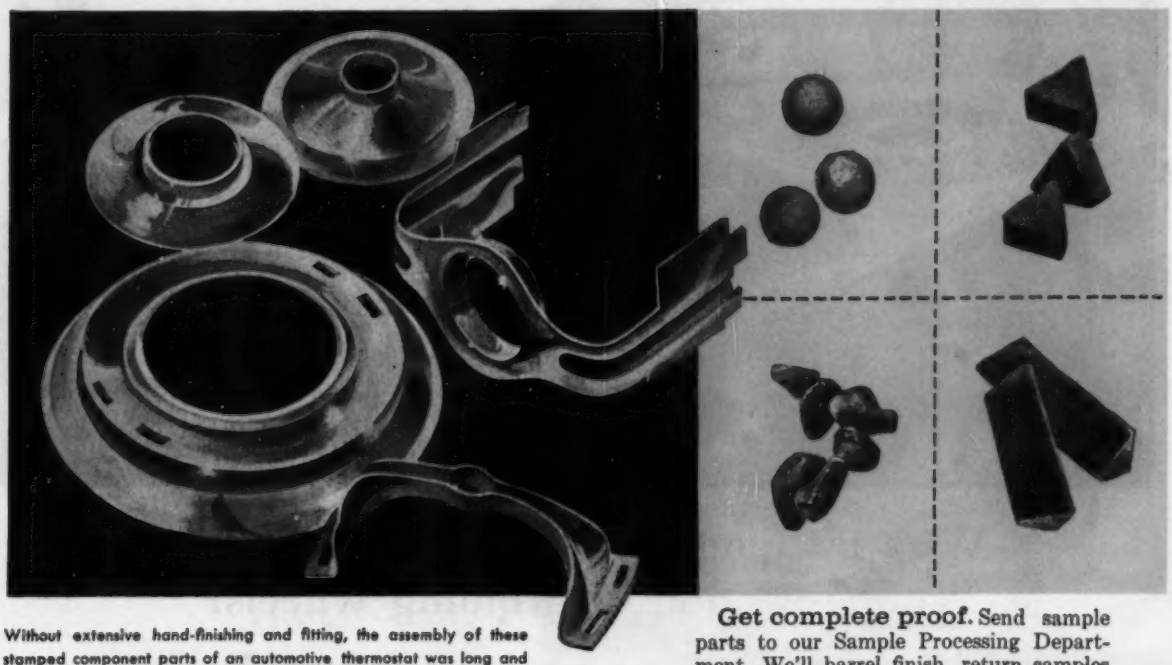
. . . to cut your assembling costs

Assembling finished parts is no longer the money-wasting problem it used to be.

Barrel finishing with Norton TUMBLEX abrasives is your modern solution . . . your surest, quickest way to remove burrs, heat scale, sharp or rough edges and other surface imperfections that keep complicated parts from fitting together smoothly and accurately.

We say *your* solution because the scope of TUMBLEX abrasives is virtually unlimited. The parts you finish . . . for assembling or for any other purpose . . . can be of any metal, ferrous or non-ferrous . . . or non-metallic including plastics and even woods . . . as hard as sintered oxides or soft as the softest machinable material . . . and their sizes can range from miniature to massive.

Barrel finishing with the right TUMBLEX abrasive not only improves your product appearance and quality — its speed and simplicity can increase your man-hour productivity and cut your cost-per-piece produced.



Without extensive hand-finishing and fitting, the assembly of these stamped component parts of an automotive thermostat was long and difficult. Barrel finishing with Norton TUMBLEX* abrasive proved unequalled for removing burrs that brought new speed to assembling.

Get complete proof. Send sample parts to our Sample Processing Department. We'll barrel finish, return samples and report the methods and abrasives you need for new production advantages. NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON ABRASIVES

D-407

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Why let long-established habit dictate your selection of grinding wheels?

Sure, the grinding wheels you've always used may be doing the job, *BUT . . . is that job good enough* in today's cost squeeze? Let Simonds help *you* update *your* grinding practices. Complete line, available through Simonds distributors, includes wheels of all abrasives and bonds, all sizes and shapes . . . all industrially-renowned products, in efficiency-proved specifications . . . and backed by our 60 year reputation as a top-rank producer of abrasive grain and grinding wheels. Send for complete descriptive catalog.

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CALL YOUR SIMONDS DISTRIBUTOR
helping YOUR business is HIS business

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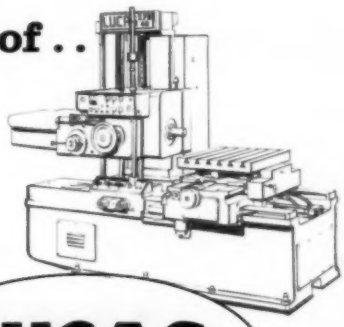
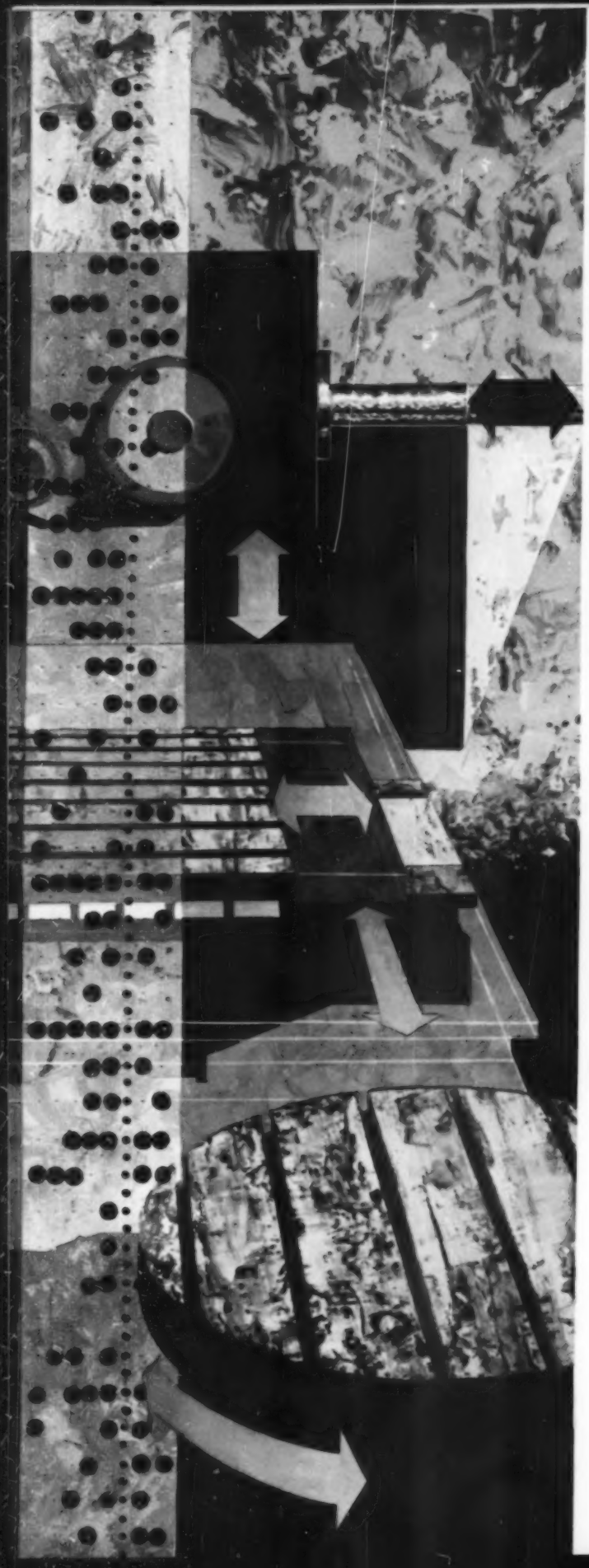
±.0001 accuracy
Versatility unlimited
Small size

The new Model 275-40 presents every famous Lucas feature, *including saddle feed*, compacted into a 2¾″ spindle machine specially suited for small, precision work. Any way you look at it, this new Lucas has the size and the machining versatility to fit into your shop or tool room setup. It's a truly profitable machine because it has so much and does so much. You get a built-in rotary table, tape programming if you want it, extreme accuracy for close tolerance machining and on-machine inspection, a new simplified control system, and many other features. Your Lucas representative can give you the whole story and arrange a demonstration right at the Lucas plant if you wish. Contact him or write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of precision machining small, intricate pieces . . .

think of . .



LUCAS
PRECISION

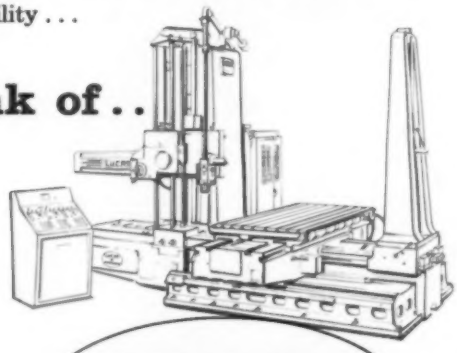


When you think of PROFITABILITY

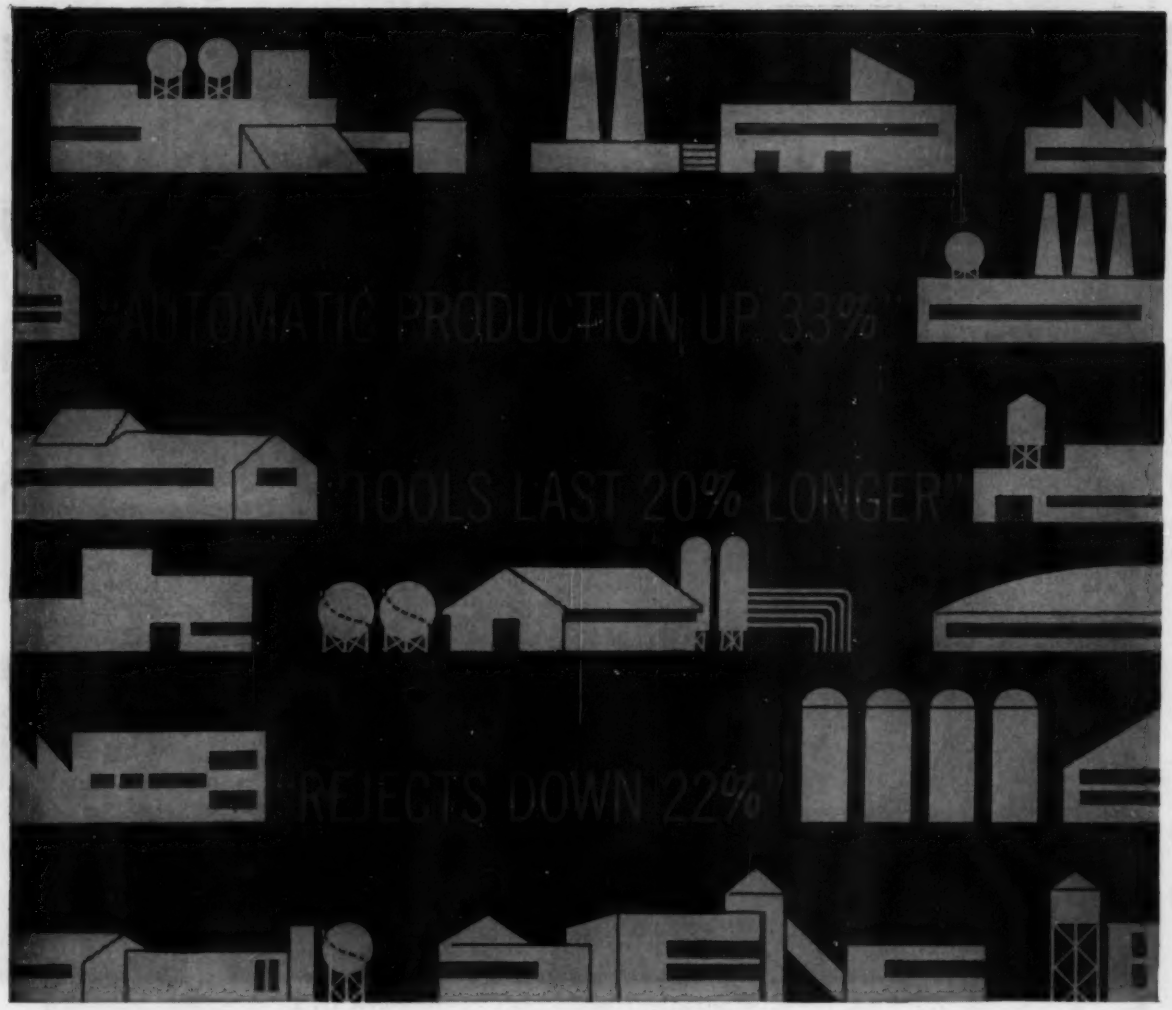
. . . think of Lucas and tape. They're made for each other. Here's why. The Lucas machine can do more horizontal boring, drilling and milling work better than any other machine on the market. Couple this basic efficiency of a Lucas with the cost savings and reliability of tape control and you have an unbeatable combination for profitable work of the highest precision.

Lucas has applied numerical controls to its full range of boring, drilling and milling machines for a number of years. The various combinations of controls available have all been successfully applied by some of the most knowledgeable metalworking firms in the country. Your Lucas representative can discuss in detail some very interesting case histories and arrange a demonstration for you. Contact him or write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of profitability . . .

think of . .



LUCAS
PRECISION



Why in the past 12 months hundreds of PLANTS HAVE SWITCHED TO CLEARTEX!

These automatic screw machine users have found that tri-purpose Cleartex has ended the problem of cutting oil dilution.

Manufacturers have found that in 7 out of 10 automatics, lube oil leaks into the cutting oil sump in spite of the most careful lubricating techniques. This diluted cutting oil can cause shortened tool life and piled-up rejects.

New Texaco Cleartex has solved the problem forever for many manufacturers. They now use Cleartex for both cutting *and* lubricating, hence the leakage that occurs no longer dilutes the cutting oil quality. The exceptional chemical stability and load-carrying ability of the Cleartex series make them equally suitable for use as cutting oils, lubricants and even hydraulic fluids.

TRY THE "CLEARTEX CURE" YOURSELF. Write today for Texaco's booklet—"Cleartex in Automatic Screw Machines." This illustrated guide will fill you in on the details, show you where you may be losing profits and how to avoid it. Or contact your local Texaco Lubrication Engineer for an authoritative study of your automatics. Just call the nearest of the more than 2,300 Texaco Distributing Plants or write to: Texaco Inc., 135 East 42nd Street, New York 17, New York. Dept. AM-62.

TEXACO

Throughout the United States
Canada • Latin America • West Africa

◄ CIRCLE 183 READER SERVICE CARD

Metal Processors, Stevensville, Michigan

Here's a Team of Mills that Really Pay their Way

When you can use South Bend Milling Machines for tool and die work and fill in free time with production runs, you've got an ideal situation. Here Metal Processors are drawing upon the two main capabilities of these machines—accuracy for exacting work and productivity for manufacturing operations.

"Double lives" are not unusual for South Bend Mills as they are readily adaptable to wide varieties of work with a minimum of effort and no sacrifice in accuracy because of such features as these:

- Head rotates 360° vertically . . . mills, bores, drills and reams at any angle
- Keyed ram saves re-setting, holds alignment
- 30 table feeds; infinitely variable quill feeds
- 32″ or 42″ tables, 20″ or 30″ table travel, 20″ spindle to table, 20″ spindle to column

Prices start at $1829 less power feeds.

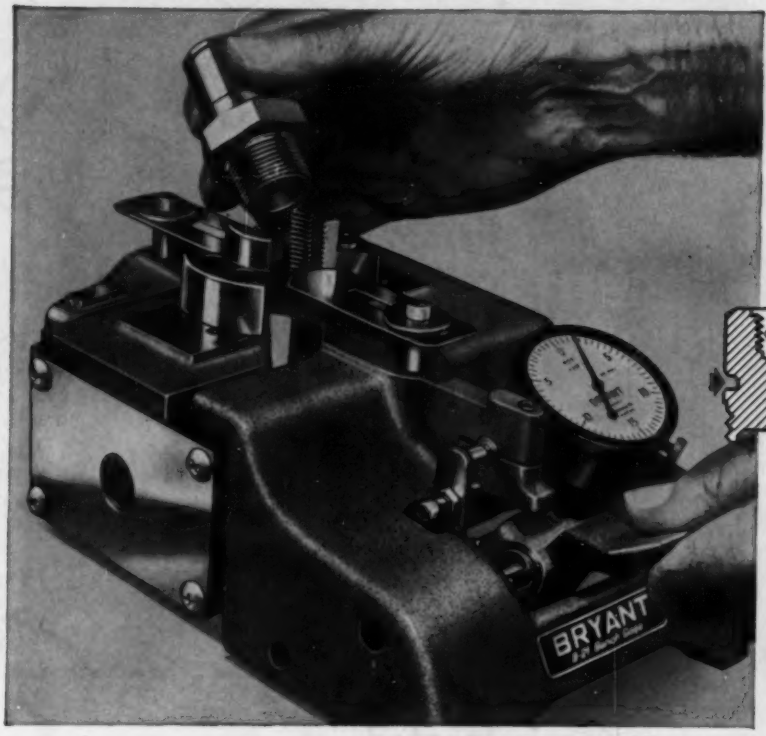
WRITE FOR COMPLETE INFORMATION

SOUTH BEND LATHE

SOUTH BEND LATHE, INC.
SOUTH BEND 22, IND.

Builders of Lathes • Milling Machines • Shapers • Drill Presses • Pedestal Grinders

All these checks . . . with one Bryant Gage!



CHECKS THREADS, GROOVES AND BORES—Bryant B-21 Bench Gage checks parts with special grooves, snap-ring or O-ring grooves, or ID and OD threads in all classes to 5" diameter—and does it 8 to 10 times faster than other methods! Stationary and movable gaging segments end the need to thread parts onto gage.

CHECKS SQUARENESS-OF-FACE—With optional Squareness-of-Face Attachment, the B-21 simultaneously checks thread size and true face run-out in relation to thread axis. Two models: One for parts up to 2" face diameter, one for parts to 7" face diameter. Attaches in seconds to the B-21 Gage.

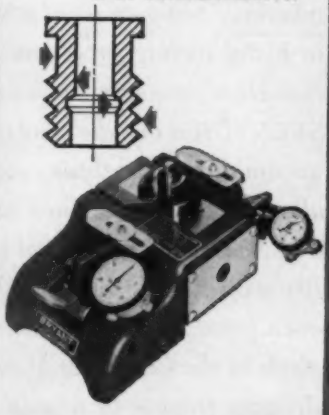
CHECKS ID CONCENTRICITY—Attachment A-9081 quickly converts the B-21 to check concentricity of bores, grooves or special internal recesses in relation to OD threads or plain OD surfaces of parts up to 8" diameter with up to 5" nominal thread size.

AND MORE—See your Bryant Gage Representative, or write for prices, engineering data, and bulletins on the standard and special accessories that make the Bryant B-21 Bench Gage indispensable to quality control throughout industry.

STANDARD B-21 GAGE

SQUARENESS-OF-FACE

I. D. CONCENTRICITY



61-42-B

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Greenville Plant, 945 E. Sater St., Greenville, Ohio

NEW BRUNSWICK DEC 3 10 AM 1960 N.J.
NEWMARKET, DEC 7 9-AM 1960 N.H.
NEW BREMEN DEC 5 8 AM OHIO.
DEC 5 7 30 AM 1960 IND.
NEW RICHMOND, WIS. DEC 5 5-PM 1960
NEW LONDON, WIS. DEC 5 5-PM 1960
NEW CASTLE, 9 30 AM 1960 PA.
NEW HAVEN DEC 5 1960 CONN.
NEW ALBANY DEC 5 11 AM 1960
NEW HYDE PARK, DEC 7 4 30PM 1960 N.Y.
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NEW BEDFORD DEC 5 8 30 AM 1960 MASS.

Wherever your tooling operation is located... here's a low-cost answer to common headaches

From New Haven to New Castle and points West . . . wherever toolmen want a simplified, low-cost answer to many tooling problems . . . Carpenter STENTOR (Oil-Hard) enjoys tremendous popularity. Here's why: STENTOR is one die steel you can live with. Its sound, uncomplicated analysis . . . free from hard-to-machine alloys . . . saves as much as 10% in machining costs. STENTOR is easy to heat treat . . . hardens at a low temperature of 1425°F to 1525°F. You'll like its freedom from decarb because STENTOR holds size so accurately many people do not even grind STENTOR tools after hardening. Little wonder it is the most widely used of all die steels in the Carpenter Matched Set of twelve! Put through an order now—you can get prompt delivery from your nearest Carpenter Service-Center.

Carpenter steel

You can do it ***consistently*** better with Carpenter Tool and Die Steels

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

CIRCLE 187 READER SERVICE CARD

Now—A Low-Cost Way to Build Jigs & Fixtures!

PRE-MACHINED MICRON SECTIONS PUT YOUR TOOLROOM JOBS ON A PRODUCTION BASIS

Next time you need fixtures for short-run milling or drilling jobs, use Ex-Cell-O Micron Sections to produce them quickly and at low, low cost!

High tensile strength cast-iron Micron Sections give you inbuilt accuracy plus substantial savings in design and building time; you eliminate welding, cut machining time.

Simply select the desired shape and size from Ex-Cell-O Bulletin B-5914, and specify the length required; we'll deliver the sections you need—pre-machined and ready for minor detailing.

Micron Sections are available from stock by ordering through your local Representative or direct from Ex-Cell-O. Send for data sheet and price list today.

BRIEF SPECIFICATIONS

Cut to order from 25″ lengths. Wall thicknesses from ⅛″ to 1¼″. Width and height from 3″ x 3″ to 8″ x 8″. Machined square and parallel within .005″ per foot on all surfaces except ends and interiors of hollow shapes.

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Machinery Division

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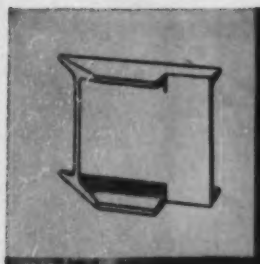
DETROIT 32, MICHIGAN

40-7



COPING AND MITERING HEAVY STRUCTURAL SHAPE

18" Beam (above) is held between vises for the short cut. On the long cut (left) vises were removed and beam held by simple clamp. The MARVEL Band Saw is truly indispensable in ornamental and structural iron shops where this type of work is done daily. The machine will cut-off square, miter and cope any work shape from the smallest moulding to 18" I-beams.

SPLITTING CLAMP RINGS, BUSHINGS

Splitting clamp rings, connecting rods, bushings and collets is a fast, simple operation on the No. 8 Band Saw. Perfect control, quick chucking facilities, accuracy and speed are features that especially fit the machine to handle this type of work.

MITERING LARGE DIAMETER PIPE

Pipe (or any bar shape) may be mitered at a 45° angle without the need for special jigs or fixtures. Even when cutting miters, work remains in the same position as it does for straight cuts. Column and blade are instantly tilted to desired angle, even without stopping the machine. Perfect miters (or lesser angles) are sawed without any layout or special equipment.

SEGMENTING LARGE DIE BLOCK

Three equally spaced re-entrant cuts were made in this 16" x 18" SAE 4130 Forging. Job was completed, floor-to-floor in 5 hours. No special jigs or fixtures were required. An unusual job that serves to emphasize the versatility of the MARVEL No. 8 Saw.

"The One Machine We Couldn't Do Without"

"As simple to use and handy as a Scout Knife" is the way another user described his MARVEL No. 8 Universal Band Saw recently . . . and we can't think of a better way to describe this versatile metal cutting machine.

With a MARVEL No. 8 Band Saw, you can do almost any conceivable straight, angle, or miter metal sawing job—from cutting-off bar stock to making the most unusual forming cuts. You can handle small, delicate work, and in the next minute, saw structurals, or segment large work as illustrated in the lower photograph. You will save time, labor, and material with a MARVEL No. 8 Band Saw because no other saw has all the features to be had in this truly universal tool.

Upright column design and forward travel of the blade through the work (which remains stationary on the table-height saw bed) provides easy, unobstructed visibility and more convenient and efficient working conditions; column can be tilted and locked at any angle up to 45° left and right of vertical; the exclusive MARVEL Power Feed with Automatic Overload Relief; Automatic cutting-depth stops; simple, convenient operating controls—these are some of the features which make the No. 8 Band Saw the most useful—and used—metal cutting saw on the market.

For the complete story, ask or write for Bulletin 875 which illustrates and describes MARVEL Universal Metal Cutting Band Saws.

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 W. BLOOMINGDALE AVE. • CHICAGO 39, ILL.

CAM BORE PRECISION... AT THREE TIMES THE SPEED OF A BAR AUTOMATIC

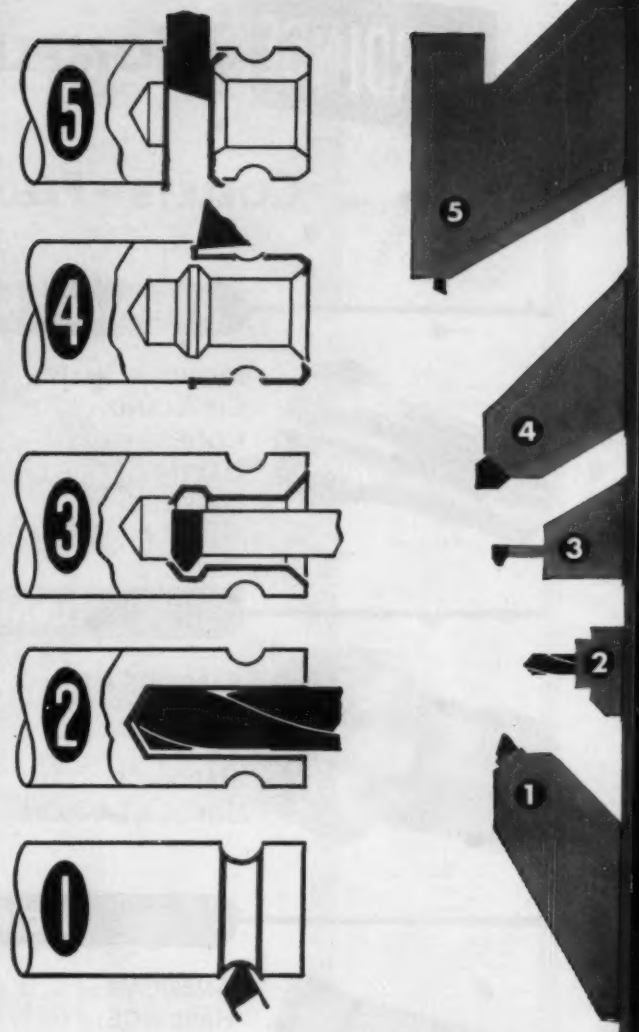
STANDARD STYLE 308 BORES AND CONTOURS MINIATURE BEARING RACES FROM BAR STOCK

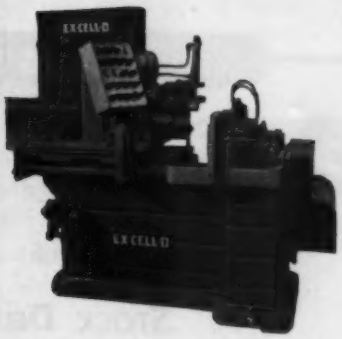
Take a standard Ex-Cell-O Style 308 Cam Boring Machine, feed bar stock through its Ex-Cell-O Precision Spindles, and add the tooling shown at right.

The result: 380 miniature bearing races per hour, gross—produced three times faster, 10 times more accurately, and with more operations and a finer finish than possible with the bar automatic assigned to the same work!

Ex-Cell-O Precision Cam Boring Machines use direct cam action on table and cross slide to perform an endless variety of boring and contouring work. To change the part form, the operator simply changes two convenient cams and tool blocks.

How many ways can you use a versatile boring machine like this in your work? Get the fact-story from your Ex-Cell-O Representative, or write direct for details on the complete line.





ABOVE: Operations are (1) generate track, (2) drill, (3) back chamfer and contour bore I.D., (4) face, chamfer and turn O.D., (5) chamfer O.D. and cut-off. LEFT: Style 308 Cam Boring Machine. FAR LEFT: Part (shown 2½ times actual size) is 440C stainless steel. Tolerance is held to plus or minus .00025", finish to 20 RMS.

60-28

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HARDINGE COMPLETE COLLET STOCKS

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AUTOMATIC SCREW MACHINES

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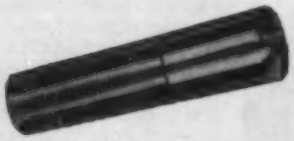

BRIDGEPORT
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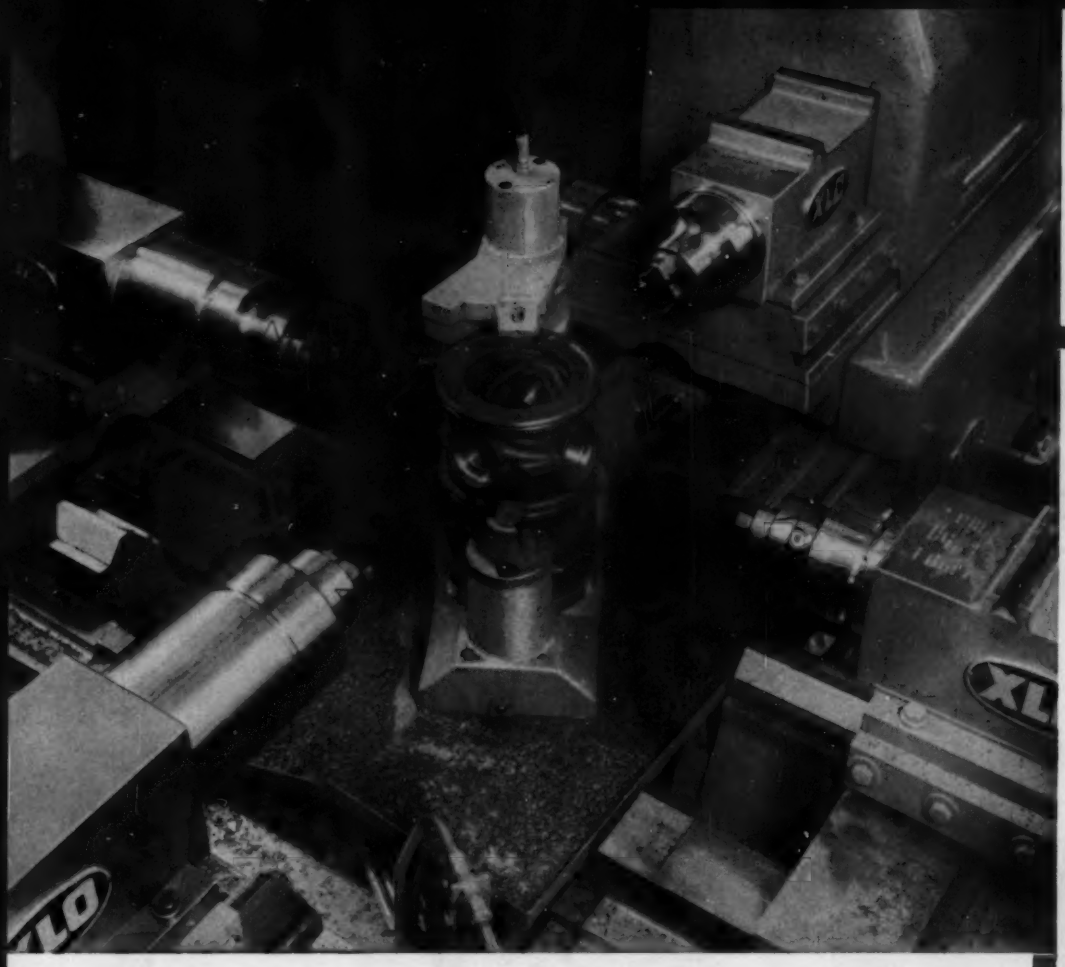
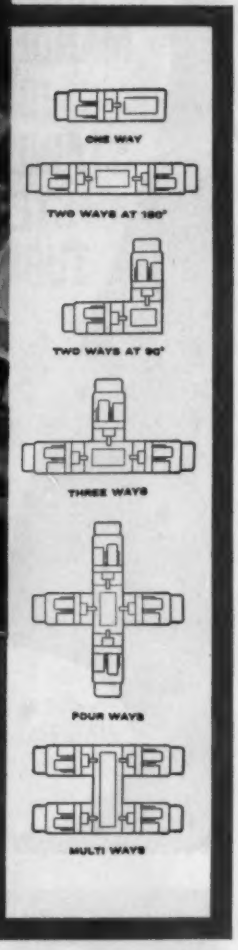
STOCK DELIVERY FROM

Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, New York, Philadelphia (Yeadon, Pa.) Seattle, Portland, Minneapolis, Oakland, St. Louis, Springfield, N.J., Toronto.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.



TYPICAL "BUILDING BLOCK" ARRANGEMENT



4-Way Production Savings with Ex-Cell-O Way Machines

1 LOWER COST Each Ex-Cell-O "Building Block" Way Machine Unit has standard base, table slide and complete, inbuilt hydraulic system. You can specify only the standard spindles or accessories that meet your present needs. **2 INCREASED FLEXIBILITY** One Way-type unit gives you a basic, versatile precision boring machine; as operations become more complex, simply add one or more Way units to a common end section to multiply production or machining functions. **3 MORE VERSATILITY** Ex-Cell-O Way Machines permit precision boring, turning, facing or grooving, chamfering or counterboring—with or without automatic cycles, work indexing or clamping. **4 GREATER CAPACITY** Using simple fixtures, you can rough or finish-machine larger, heavier work than possible on most standard boring machines.

Ask your Ex-Cell-O Representative about savings with Way-type Machines, or write direct for details.

Typical setup shows four units positioned at 90° for simultaneous rough boring, counterboring and trepanning. Beds, tables, center section, hydraulic systems, controls and Ex-Cell-O Precision Spindles are standard components. Units can be rearranged at any time.

60-29

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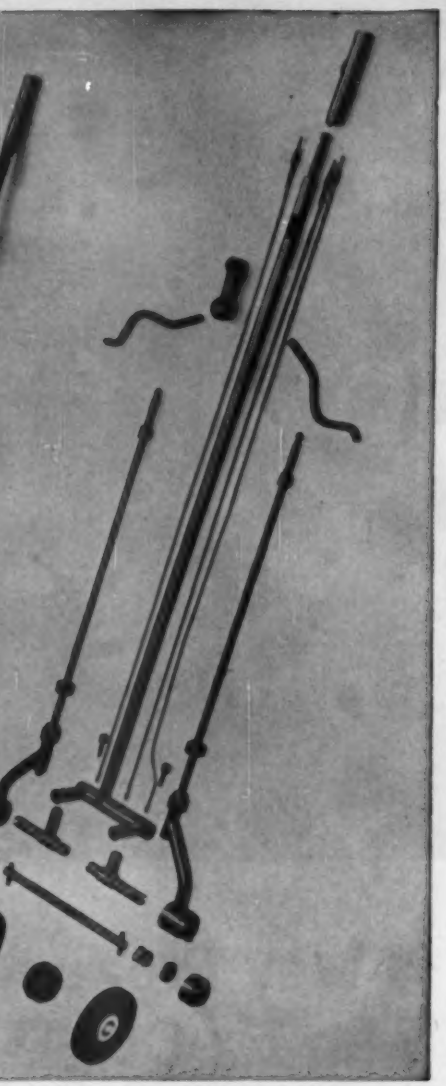
Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

CIRCLE 192 READER SERVICE CARD

HERE'S HOW STILL ANOTHER MANUFACTURER JOINS STAINLESS STEEL TUBING:

He uses Handy & Harman's BRAZE 630



He's one of many manufacturers and fabricators who have found—to their lasting satisfaction—that Handy & Harman silver alloy brazing is the final answer to stainless steel joining problems.

Super-Donic Manufacturing Company, Atlanta, Georgia, manufactures "Dual Arm Transmissions" for the dental industry. Most everybody has—at one time or another—seen and/or felt this unit in operation.

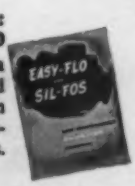
It is fabricated of small diameter 304 and 316 stainless steel tubing and, in its assembled form, consists of some 17 separate brazed joints. Joints must be strong, corrosion resistant and neat-appearing.

Each of the 17 joints is hand-torch brazed with Handy & Harman BRAZE 630 wire and HANDY FLUX TYPE B-1. There's no question that this is a unique application. There's no question, either, that the application is stainless steel. The ease and economy with which this manufacturer solves his problems can be just as readily applied to *your* stainless steel joining problems.

Strength, production speed, electrical and thermal conductivity, gas and liquid tightness and low cost are *natural* benefits of silver alloy brazing. We think it worth your while to learn more about this remarkable metal-joining method—we'll be glad to send you any information you ask for. Handy & Harman, 82 Fulton St., New York 38, N. Y.

FOR A GOOD START: BULLETIN 20

This informative booklet gives a good picture of silver brazing and its benefits . . . includes details on alloys, heating methods, joint design and production techniques. Write for your copy.



Your No. 1 Source of Supply and Authority on Brazing Alloys

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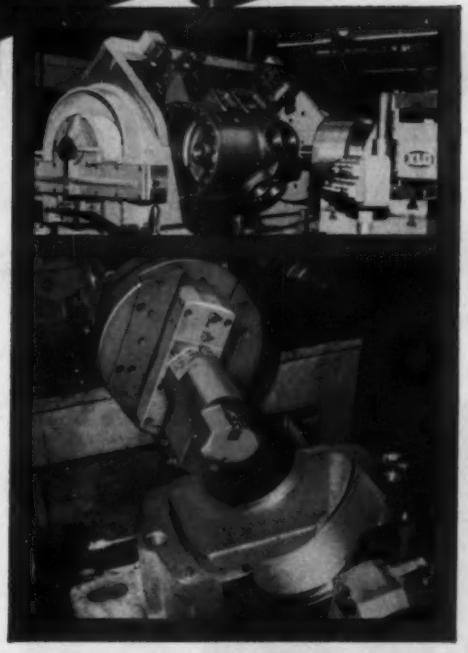
STANDARD EX-CELL-Os
for large, heavy parts!



- Accuracy, heavy cuts and good finishes on large parts are the high-production features of Ex-Cell-O Models 771 and 772 (double-end) Horizontal Precision Boring Machines
- These precision-built workhorses have husky nickel cast-iron bases with wide-spaced ways, extra-strong tables to handle the heaviest fixtures and workpieces, and infinitely adjustable hydraulic feeds in both directions for maximum cycling efficiency.
- A range of standard spindles, bridges and drive equipment lets you custom-equip Models 771 and 772 to suit your particular precision boring, turning, facing, grooving and chamfering operations.

Contact your Ex-Cell-O Representative or write direct for details.

Typical of parts handled by Models 771 and 772 are large air conditioning compressor housing castings (main illustration and close-up above), and cast-iron pillow block bearing support housings (bottom photo). Machine takes ⅝" cut as it roughs, finish-bores, and generates interior form of support housing in a single cycle.

60-23

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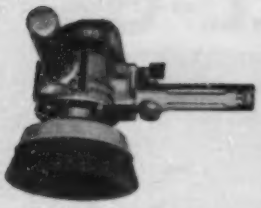
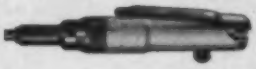
pick your production-proved Cleco Air Tool



Vertical Grinders

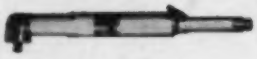
Vertical Wire Brush Machines

Drills



Screwdrivers

Screwdrivers



Nutrunners

Impact Wrenches

Die Grinders

Horizontal Wire Brush Machines

Scalers

Scalers

Chippers

Riveters

Squeeze Riveters

The tools pictured above are only a representation of the hundreds of Cleco Air Tools available.

For detailed information on Cleco's complete line of production-proved air tools and accessories, or for a demonstration-tryout, contact your local Cleco representative or write:

Rammers

Paving Breakers

Clay Diggers

A Division of **Reed Roller Bit Company**
P. O. Box 2541 Houston 1, Texas, U. S. A.

Cleco Pneumatic Tool Company of Canada, Ltd.
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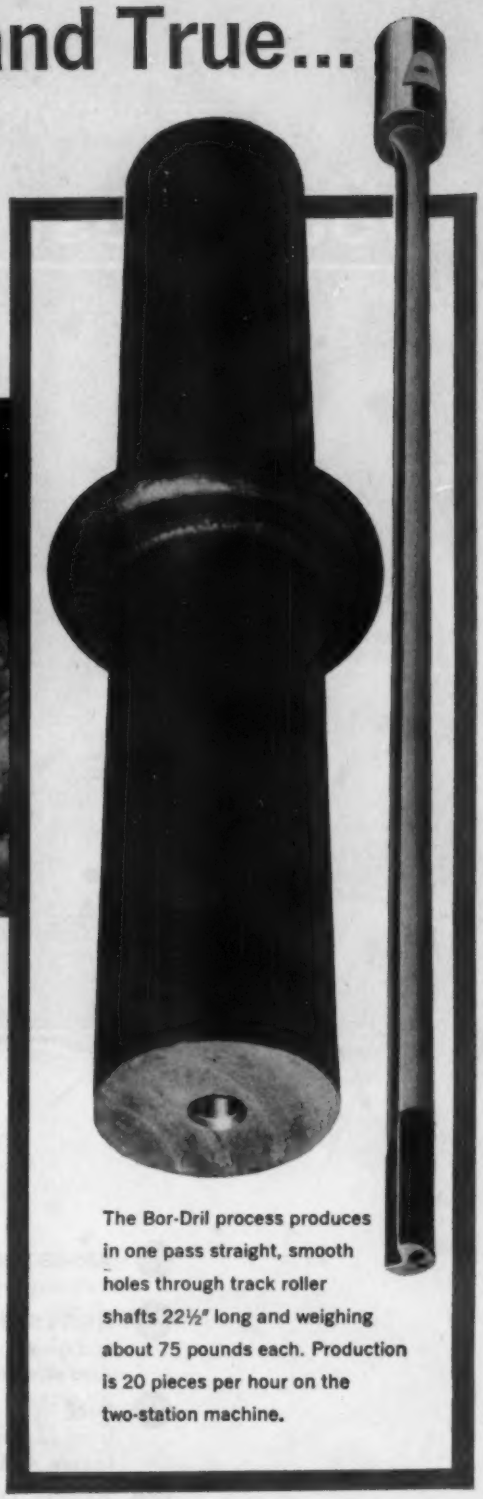
"quality tools engineered for industrial progress"

CLECO
AIR TOOLS

Deep Holes...Fast and True... with Ex-Cell-O

BOR-DRIL



The Bor-Dril process produces in one pass straight, smooth holes through track roller shafts 22½" long and weighing about 75 pounds each. Production is 20 pieces per hour on the two-station machine.

Drilling 11/16" diameter holes the full length of 22½"-long forgings posed a tough problem for production engineers who need the economy of volume output, the time-savings of one-step operations, and the performance of precision equipment. But they found the answer in Bor-Dril, Ex-Cell-O's process for gun-type drilling with standard production boring machines.

Measured in terms of production efficiency, the result is 20 pieces per hour, from an Ex-Cell-O Model 752 Precision Boring Machine set up for Bor-Drilling. Secondary operations are eliminated.

Bor-Dril can be applied easily and economically wherever you have long, small-diameter holes to produce to precision tolerances. See your Ex-Cell-O Representative, or submit your requirements direct to Ex-Cell-O for prompt analysis and cost estimate.

60-30

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Machinery Division

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

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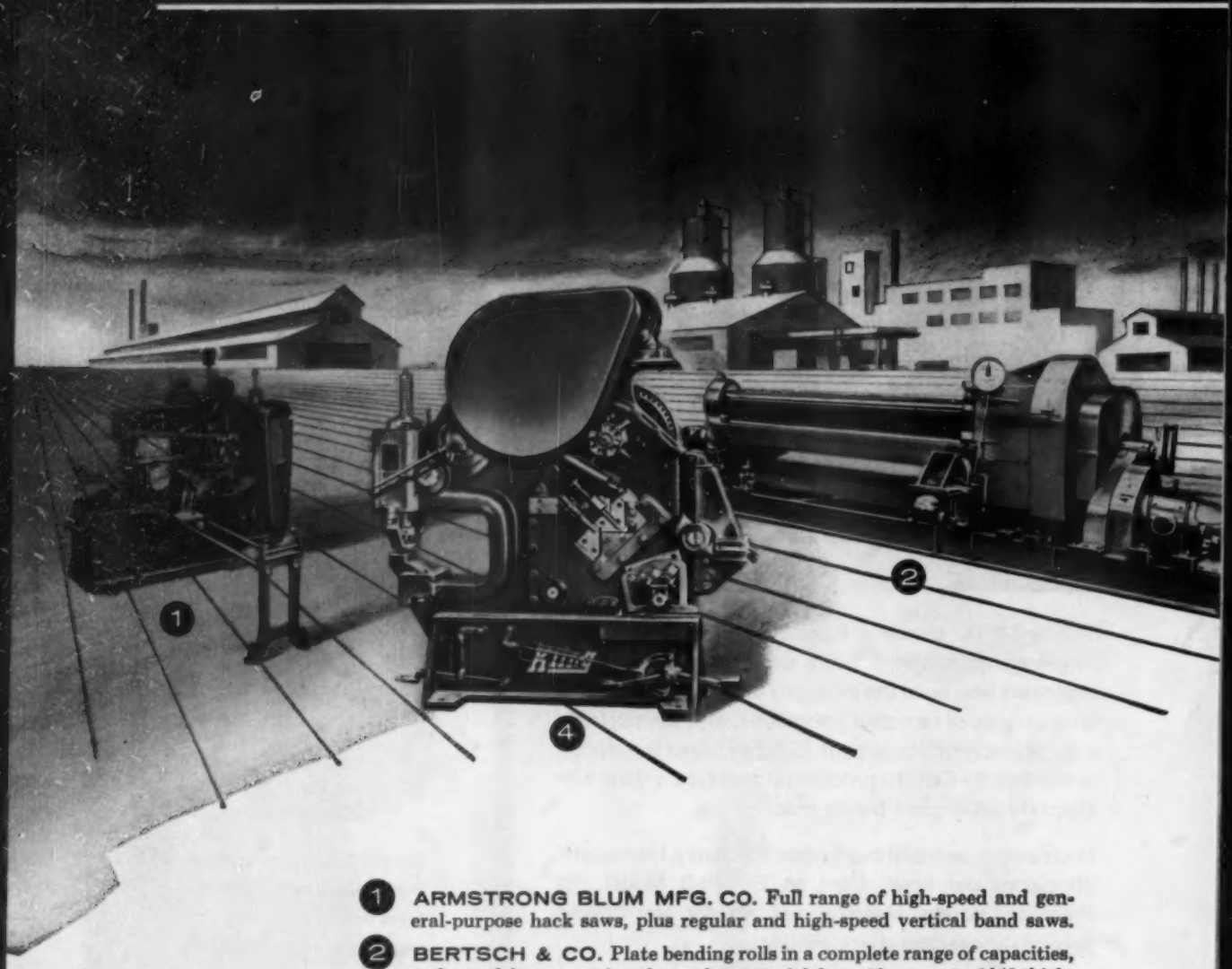
your most complete source



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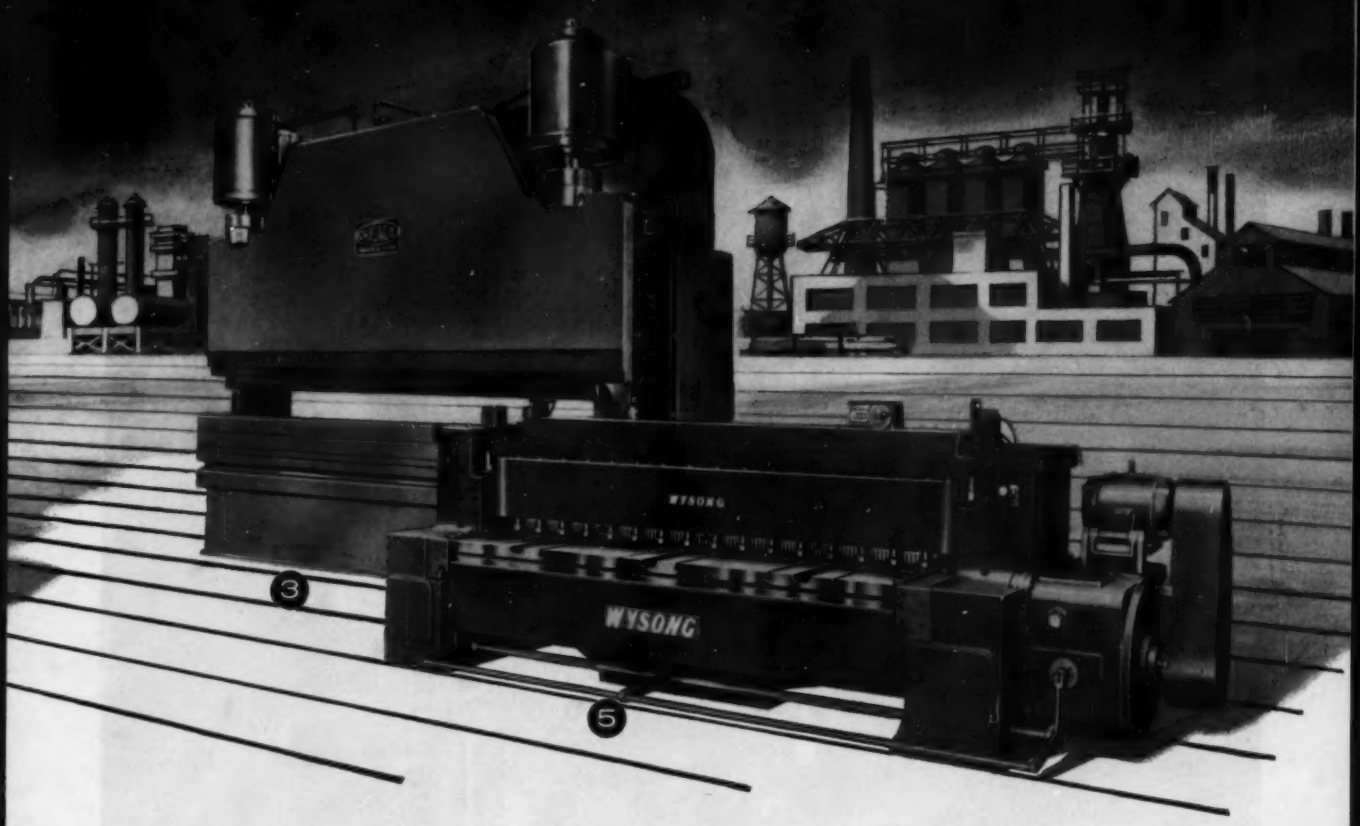
for metalworking machinery



No other single supplier of machinery for metal fabrication can offer you the range of types and models available from Ryerson. So, with no other supplier can you be so sure of getting exactly the right machine to do each fabricating job best at lowest cost.

We represent nearly 100 manufacturers, each a recognized leader in its field. The five featured on these pages represent five good reasons why it will pay you to call in a Ryerson representative when you're considering a machinery purchase. His recommendations are backed by Ryerson experience gained in supplying metal *and* the machinery to fabricate it for over a century.

Our complete line includes equipment for bending, braking, forming, hoisting, drilling, pressing, punching, rolling, sawing, shearing, threading and welding.

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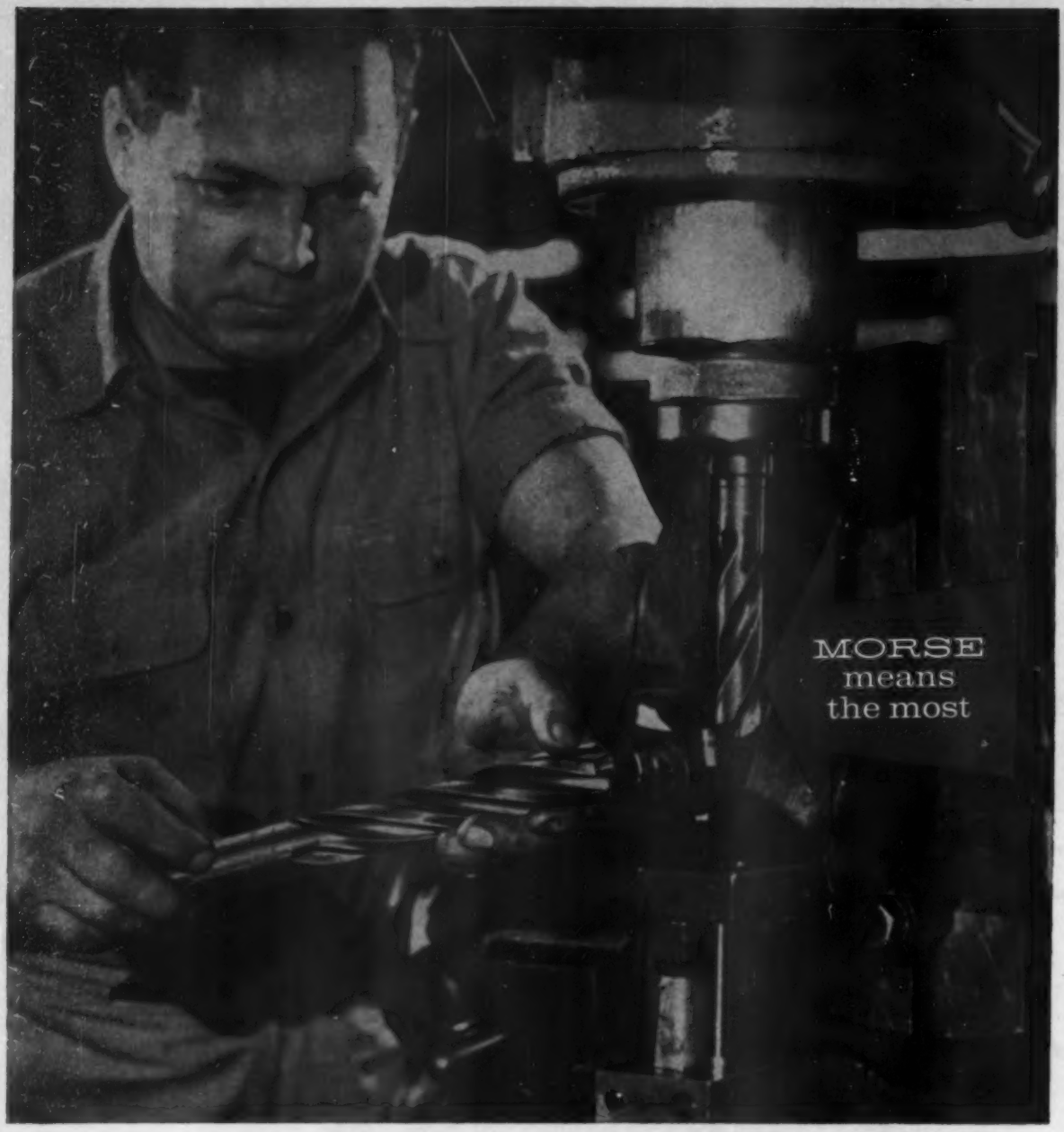

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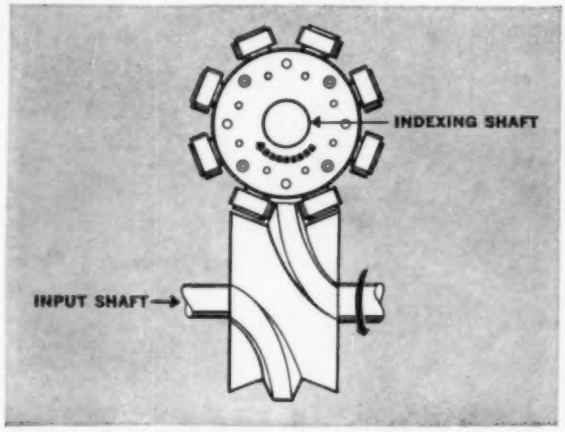
How Ferguson *ELIMINATES BACKLASH* in Index Tables

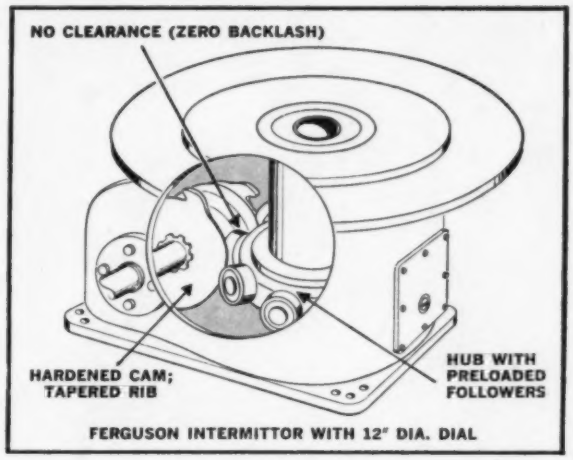
Backlash in indexing results in shock loads that affect the efficiency of a machine and the quality of its product. Most indexing mechanisms have inherent characteristics that cause backlash and poor dynamic conditions and prevent the designer from taking full advantage of modern feeds, tooling and methods that contribute to production economy.



Ferguson Intermittor Index Tables have inherent zero backlash and extreme precision which results in a rotary transfer machine base capable of operating speeds up to 500 indexes a minute. *A Ferguson index table never proves to be a limiting factor in the speed or performance of an automatic assembly machine.*

HERE'S WHY: The continuously rotating cam of a Ferguson indexing mechanism features a *tapered rib* along which two preloaded bearing followers roll, maintaining constant contact with no clearance between them and the rib. When the mechanism is in the rest, or dwell, position, a straight portion of the rib locks the followers with zero backlash and an indexing accuracy of .001". Wear on the hardened tool steel cam is infinitesimal (many have been in use for more than 25 years). Followers are rated for a minimum of 8,000 hours operation. If backlash occurs after this period the life of the drive may be renewed merely by replacing the standard followers.

NOTE HOW PRELOADED FOLLOWERS ENGAGE RIB



FERGUSON INTERMITTOR WITH 12" DIA. DIAL

Compare this with other types of indexing devices. A geneva drive, with its slotted wheel and driver, and a barrel cam with a grooved track which engages one follower at a time, must have clearance in the slot or groove to allow passage of the follower. The slightest amount of clearance causes backlash. As the slot or groove wears, the clearance becomes greater and the backlash condition worsens. At the higher, more profitable operating speeds poor dynamics cause wear on other parts of the machine. The user must choose between frequent downtime for repairs or slower speeds . . . He is the loser in either case.

FREE DESIGN DATA — Load ratings, dimensions and application and installation information about standard and stock Intermittors, Ferguson Drives and in-line machines are contained in a single 36 page catalog. Every designer should have one in his library . . . Write Ferguson—Ask for Catalog No. 160.

FERGUSON
MACHINE COMPANY
A Division of Universal Match Corporation
7818 Maplewood Court • St. Louis 17, Missouri

AT BLACK & DECKER

Jalcase 100 Cold Finished Bars Speed Tool Parts Production 50%

Here's what happened when Black & Decker Manufacturing Co., Towson, Maryland, switched from alloy grades 4140 and 8620 to J&L Jalcase 100 cold finished bar steel in the production of shafts, gears and pinions for portable electric tools:

- The free machining quality of Jalcase speeded production on automatic screw machines 50%.
- The uniform machinability of high strength Jalcase eliminated ½ hour per shift from machine downtime for tool changes.
- The strength and hardness of Jalcase have practically eliminated the need for subsequent heat treating and resultant part distortion.
- The combination of these production economies plus the lower initial cost of Jalcase over alloy grade steel has greatly reduced parts costs.

The free machining qualities of J&L Jalcase 100 plus its high strength, hardness and stabilized stresses make it an ideal cold finished bar steel for producing high quality machined parts for the metalworking industries.

Jalcase 100 has a minimum yield strength of 105,000 psi in round bar sizes to 1½" diameter and a minimum yield strength of 100,000 psi in sizes to 3½" diameter.

Jalcase 100 has a minimum hardness of 248 Brinell up to 1½" and 241 Brinell for larger sizes. It is also available with a lead addition, designated as Jalcase 100-L, for applications requiring superior machinability.

For literature write direct to *Jones & Laughlin Steel Corporation, Department 480, 3 Gateway Center, Pittsburgh 30, Pennsylvania.*

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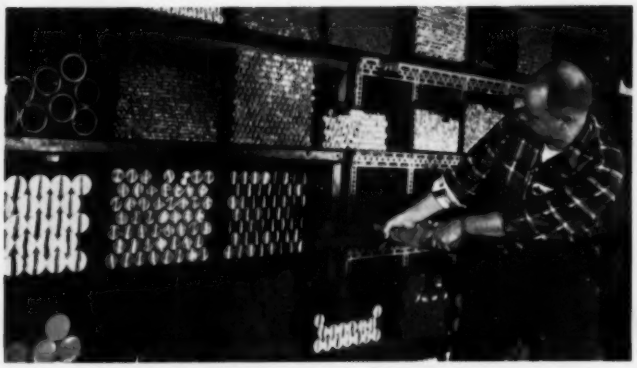
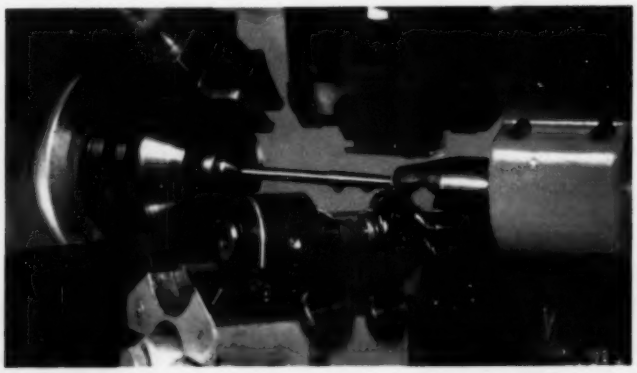
Where cold rolled steels originated in 1859



Black & Decker relies on a great variety of J&L bar stock. Over 30 electric tool parts are made from Jalcase 100 alone.

Made from Jalcase 100, these armature shafts are used in Black & Decker's ¼" Portable Electric Utility Drill.



▲ Black & Decker hobs pinion gears made of Jalcase 100 to tolerances of less than .001".

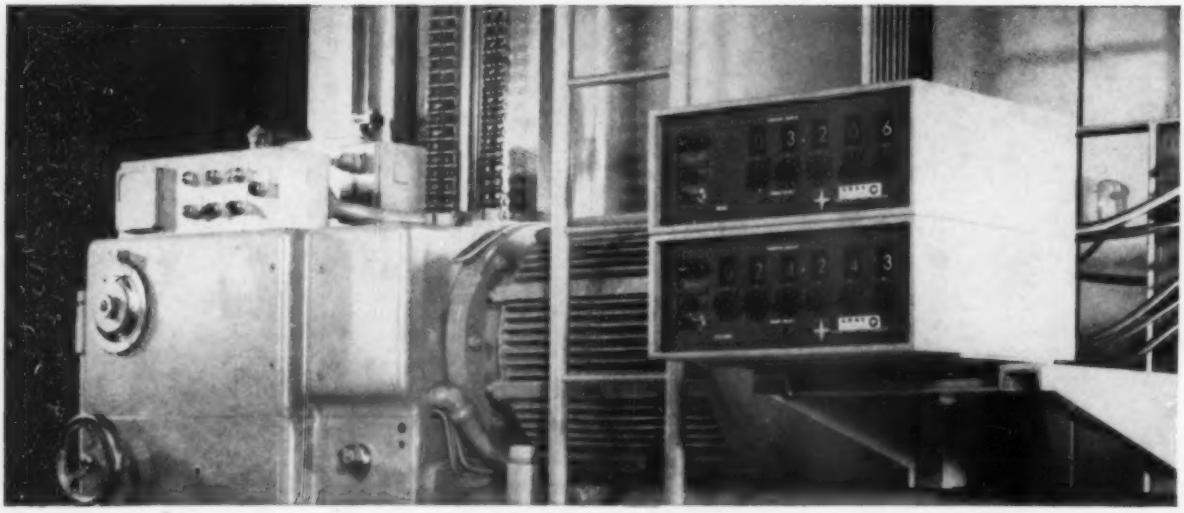
◀ Palletized trays transport a few of the many B&D machined parts that are made from J&L bar stock.

J&L STEEL

NORDEN Modumatic Control for New and Existing Machines

Series 100 features

- ☆ Actual Position Readout
- ☆ Decimal Display
- ☆ Full Range Origin Select



IF you have the time-consuming problem of rotary or linear positioning, then you are aware of the importance of knowing the exact location of the tool or the work piece. Up until now this was a tedious, time-consuming process requiring calculation and dial reading, both subject to human error. Norden's Series 100 display system eliminates all this and performs the calculations automatically. What's more, it can be installed on **new** and **existing** machines.

The Series 100 numerical control system utilizes a unique position feedback transducer, electronic circuitry and a visual display to indicate the **actual** position of the tool or work piece.

The **actual** position is displayed in straight decimal form by illuminated numbers that are readable from twenty feet. The display unit may be located on the machine or remote.

This Norden Modumatic system also offers a full range electronic origin select so that any desired offset can be quickly and easily dialed in by the operator on manual selector switches.

For more information about this position display system or other Modumatic control systems contact your nearest Norden Representative—400 Main Street, East Hartford, Connecticut, JAckson 8-4811, 11 West Monument Ave., Dayton 2, Ohio, BAldwin 8-4481, or write to us at the address below.

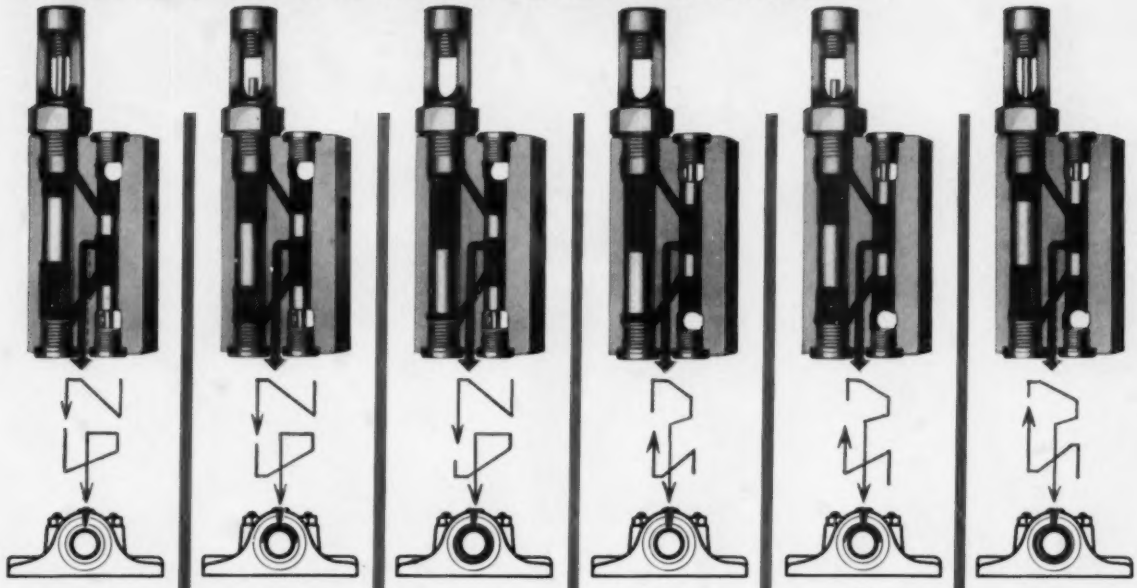
A new concept in Numerical Control from ★ NORDEN ★ DIVISION OF UNITED AIRCRAFT CORPORATION

DATA SYSTEMS DEPARTMENT

COSTA MESA, CALIFORNIA

Here's design simplicity

Farval's Time-Tested Dualine Valve



1

(In red) Lubricant under hydraulic pressure enters inlet at top right — pushing slide valve down and filling upper diagonal passage and chamber above main piston.

(In blue) By this movement, lower head of piston slide valve uncovers lower diagonal passage leading from the main piston chamber. This chamber is full of lubricant from the previous operation.

2

(In red) Lubricant under pressure entering through upper inlet port and into main chamber continues to force main piston downward —

(In blue) discharging lubricant through lower diagonal passage to vertical passage and to outlet port leading to bearing.

3

(In red) Lubricant entering from upper port has now forced the main piston to end of its stroke, and thus the full measured charge below piston has been delivered to the bearing.

Note that indicator stem has also moved down, indicating main piston has reached end of its stroke, and that no more lubricant will be delivered from this operation.

4

(In blue) Lubricant under hydraulic pressure enters inlet at bottom right — pushing slide valve up and filling lower diagonal passage and chamber below main piston.

(In red) By this movement, upper head of piston slide valve uncovers upper diagonal passage leading from the main piston chamber. This chamber is full of lubricant from the previous operation.

5

(In blue) Lubricant under pressure entering through lower inlet port and into main chamber continues to force main piston upward —

(In red) discharging lubricant through upper diagonal passage to vertical passage and to outlet port leading to the bearing.

6

(In blue) Lubricant continuing to enter under pressure from the lower port has now forced main piston to the end of its stroke, and thus the full measured charge above piston has been delivered to the bearing.

Indicator has reached its top limit, showing the job is done.

That's why *FARVAL DUALINE* is today's most dependable, positive system of centralized lubrication

Write for free copy of Bulletin 26-T — it gives the complete Farval "Story".

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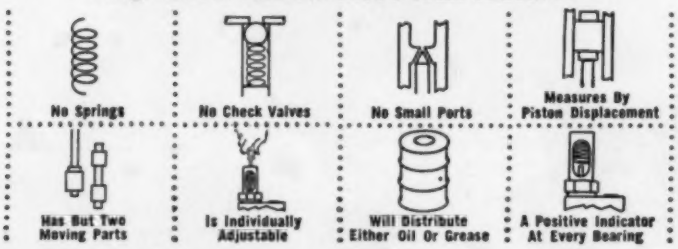
Farval Studies in Centralized Lubrication No. 255

Only Farval has all these vital features


No Springs
No Check Valves
No Small Ports
Measures By Piston Displacement
Has But Two Moving Parts
Is Individually Adjustable
Will Distribute Either Oil Or Grease
A Positive Indicator At Every Bearing

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CIRCLE 205 READER SERVICE CARD ►

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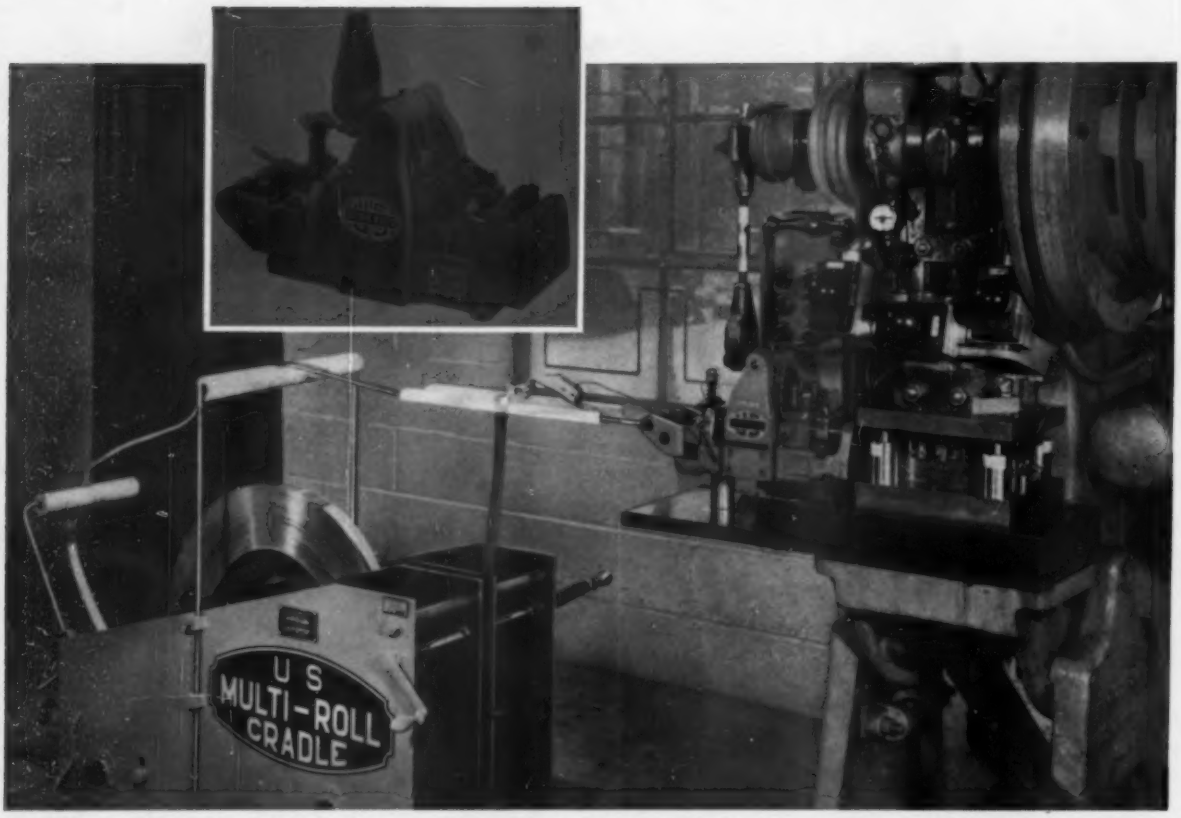
U.S. Slide Feed produces at 620 strokes per minute ...tolerances to ±.001"



U.S. Slide Feed No. 22A, adapted for high speed production and U.S. Multi-Roll® Cradle No. ACC-19C at Triangle Tool Company.

Triangle Tool Company, Union, N. J., using U.S. Slide Feeds, runs continuous production at the rate of 620 strokes per minute. Coil stock, 1010 dead soft, .010" thick x 2" wide is fed into a 9-station all carbide progressive die. Feed length is 1.125". Tolerance is held to ± .001" without the aid of pilots. ■ Of all feeds tried by Triangle Tool Company, only the U.S. No. 22A Slide Feed proved capable of maintaining the required tolerance at this high speed. ■ The Feeds used are a variation of standard No. 22A U.S. Slide Feeds modified for high speed operation.

Bulletin #85-60-A describing U. S. Press Room Equipment will be sent upon request.

MULTI-SLIDE

U.S. TOOL COMPANY, INC.

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U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

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FAFNIR

for leadership in ball bearings

Where cost is your problem...

Costs can nip good design ideas in the bud. Fafnir helps cut costs with Flangette Units. Millions of these ball bearing "economy packages" — a Fafnir "first" — are used to improve performance and reduce maintenance on products ranging from small conveyors to giant combines. When you're up against costs... or *any* bearing problem . . . look to Fafnir. The Fafnir Bearing Company, New Britain, Connecticut.

50 YEARS OF EXPERIENCE
IN THE MANUFACTURE OF
BALL BEARINGS

FAFNIR
BALL BEARINGS

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ball bearings

Where dirt is your problem...

Dirt is cheap . . . but not when it gets into bearings. It handicaps production . . . runs up costs . . . shortens product life. How to keep dirt out? Disc harrow makers do it with Fafnir Ball Bearings . . . triple-sealed to "run clean" where it's dirtiest. When you're up against dirt . . . or *any* bearing problem . . . look to Fafnir for the diversity, the capacity, the research to find your answer. The Fafnir Bearing Company, New Britain, Conn.

FAFNIR
BALL BEARINGS

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Look to
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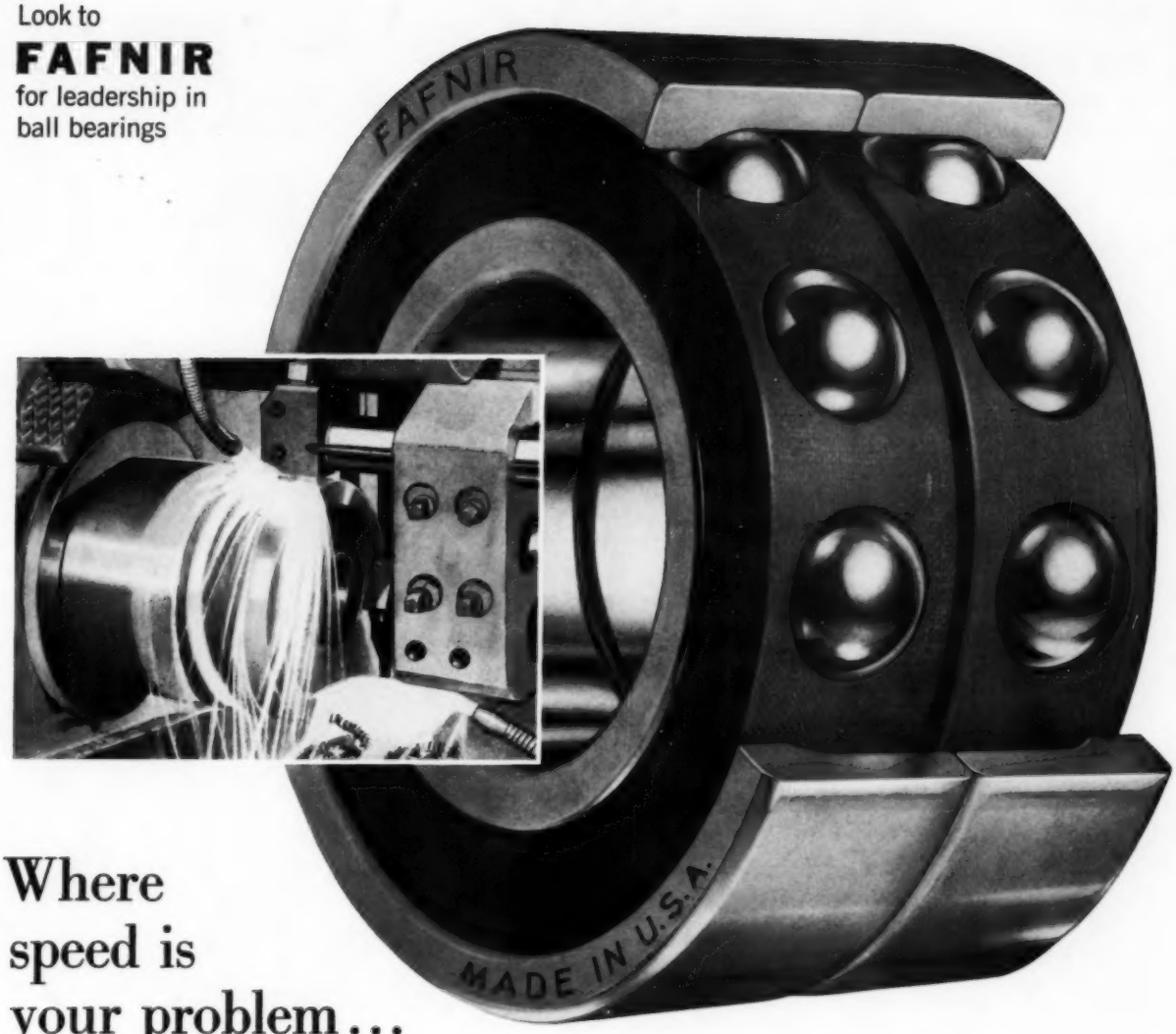
for leadership in
ball bearings



Where speed is your problem...

Today's high speeds put the spotlight on bearings. For when bearings fail, costs rise . . . and profits drop. Machine tool builders know this. That's why they specify Fafnir Ball Bearings for high speed applications — 100,000 rpm and up. So, when you're up against speed . . . or *any* bearing problem . . . look to Fafnir for the diversity, the capacity, and the research to find your answer. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR
BALL BEARINGS

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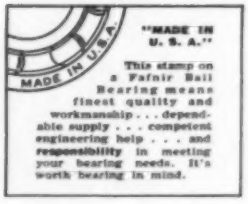
Look to
FAFNIR
for leadership in
ball bearings

Where heat is your problem...

Some bearings "freeze" under prolonged high heat. When they do, performance drops off . . . costs rise . . . and the heat's on *you!* The answer? Fafnir Ball Bearings engineered for high temperature service. For instance, in the X-15 manned rocket, they're used by the hundreds at critical points. So, when you're up against heat . . . or *any* bearing problem . . . look to Fafnir for the diversity, the capacity, the research to find your answer. The Fafnir Bearing Company, New Britain, Connecticut.



"MADE IN U. S. A."

This stamp on a Fafnir Ball Bearing means finest quality and workmanship . . . dependable supply . . . competent engineering help . . . and responsibility in meeting your bearing needs. It's worth bearing in mind.

FAFNIR
BALL BEARINGS

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Another NEW Jones & Lamson Optical Comparator
THE ECONOMY MODEL 14″-SCREEN PC-14A

This new 14″-screen universal measuring and comparison machine incorporates lateral, vertical and angle measuring facilities. It offers a combination of important features that set the standard for practicality, price, and performance:

1. All measurements read directly to .0001″ without computation.
2. High-intensity fan-cooled illuminating units for sharp definition of shadow image.
3. No adjustments when changing magnifications. A full range of *J & L Telecentric Projection Lenses* is available, from 5X to 125X.
4. Three table styles are available; a plain table as well as 18″ and 30″ ball or roll type measuring tables.
5. Work capacity — either 5″ or 8″ in diameter with max. of 24″ between centers.

Many other features such as new normal light reflection unit, tracing attachments and super-high-pressure mercury arc illumination, are available.

See this machine in action at Booth #308, ASTME Show, Los Angeles. Or call one of our West Coast representatives: Germain Machinery, Los Angeles and Phoenix; Moore Machinery, Berkeley; Perine Machinery & Supply, Seattle; Allied Northwest Machine Tool Corp., Portland and Salt Lake City.

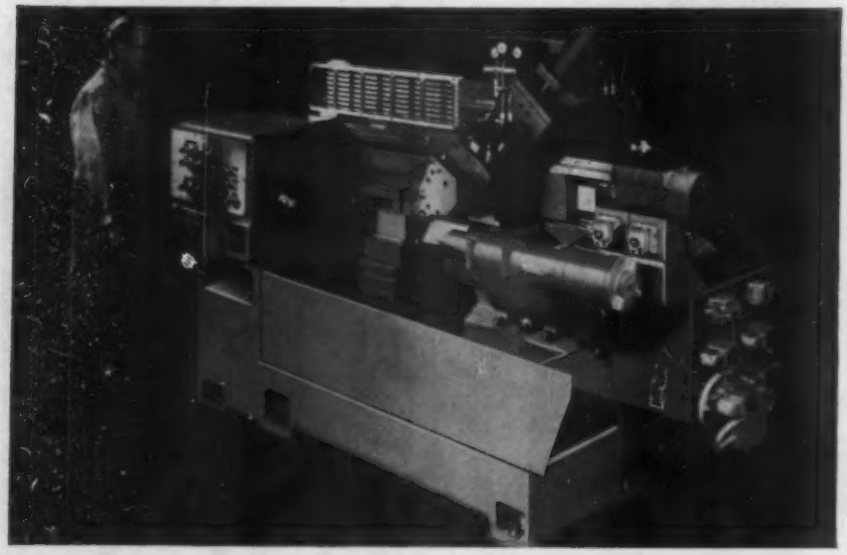
JONES & LAMSON

COMPARATOR DIVISION

Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vt., U. S. A.

SUNDSTRAND "Engineered Production" METHODS

practical ideas for men who are responsible for manufacturing quality, quantity, and profit



Part — Clutch Shaft, #1345 Steel, 2-7/8" x 18" long.
Changeover time from Op. -1 to Op. -2 is less than 3 min.

Op. 1 — Rough and finish turn large end. Time 1.125 min.

Op. 2 — Rough and finish turn opposite end and roll thread. Time 2.536 min.

TURNING and THREAD ROLLING

Sundstrand multicycle tracer lathe combines automatic operations on clutch shafts to minimize machining time and handling

Machining costs on many parts requiring turning and related operations can be substantially reduced through use of Sundstrand multicycle hydraulic tracer lathes. The clutch shaft illustrated is a good example. Rough and finish turning and thread rolling all are performed automatically on a Model 14T machine.

During turning operations the thread rolls are protected against chips by a guard.

The thread roll guard automatically moves aside as machine cycles for thread rolling operation.

A single fixed-position template is used. The ruffing tool on this lathe will take up to three cuts automatically, then the finishing tool indexes into position. Extreme accuracy is assured by this operating principle (on many types of parts the need for rough grinding operations is eliminated). Ease and speed of setup makes the machine practical for small as well as large production lots.

The Sundstrand Model 14T lathe is available in two standard sizes — 25 and 40 hp.

For details and specifications ask for Bulletin No. T-.

SHORT-RUN TRANSFER MACHINING

Lots as small as 500 to 1000 parts are practical because of quick change-over design

Quick-change tooling gives this Sundstrand 6-station pallet-type transfer line short-run efficiency. Low cost multiple-spindle heads and workholding pallets can be interchanged for a new job setup in less than 10 man-hours.

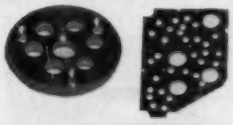
The machine illustrated is being used to process a family of five different hydraulic unit housings in lots as small as 500 to 1000 pieces. Operations include drilling, spotfacing, boring, and tapping to precision tolerances. Milling and boring heads can be added to or replaced in the line as required.

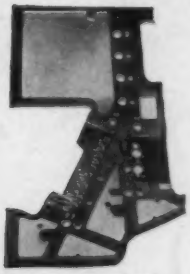
Quick change of heads and fixtures makes automation practical for small lots of similar parts.

The development of practical short-run transfer machines is typical of the benefits of the Sundstrand "Engineered Production" approach to machining cost reduction. Details available upon request.

MULTIPLE-SPINDLE DRILLING

New machines provide high accuracy, fast change-over, and new economy even on moderate-sized production lots.





Sundstrand multiple-spindle precision drilling, boring, reaming, and tapping machines represent a new cost-cutting approach to machining large numbers of holes in relatively complex parts — even when production runs are moderate.

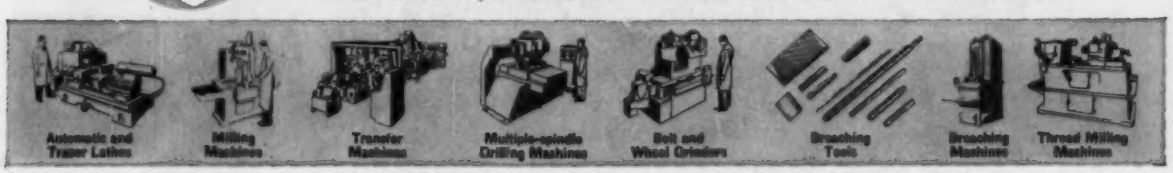
Key to the economy of the machines is the unique low-cost design of the heads which eliminates gearing and permits complete change-over in 15 to 20 minutes. Tolerances to .0002″ for spatial relationship, shoulder depth, and hole size can be maintained, depending upon the nature of the work. Inspection requirements are minimized because of the accuracies built into the head, fixtures, and machine itself.

For more information, ask for Bulletin No. D-125.

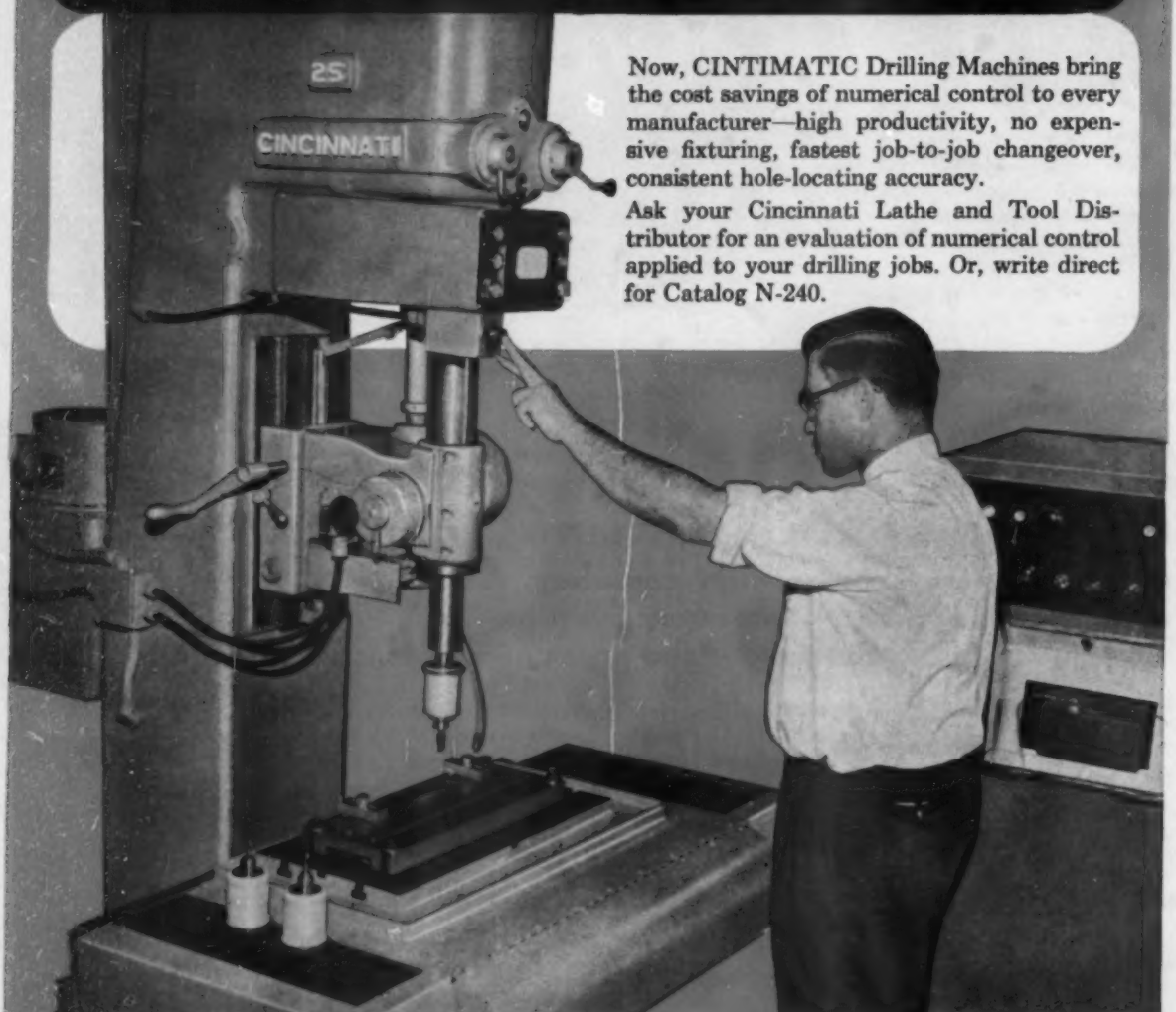
SUNDSTRAND

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION



Cut Your Drilling Costs With
CINTIMATIC NUMERICAL CONTROL...
only $13,155!*



Now, CINTIMATIC Drilling Machines bring the cost savings of numerical control to every manufacturer—high productivity, no expensive fixturing, fastest job-to-job changeover, consistent hole-locating accuracy.

Ask your Cincinnati Lathe and Tool Distributor for an evaluation of numerical control applied to your drilling jobs. Or, write direct for Catalog N-240.

* This low, complete price includes 25" numerically controlled drill with complete electrics, power feed, back gear, and Infispeed variable speed drive; 10" x 20" tape controlled, hydraulically operated positioning table; Cincinnati Acramatic control console with tape reader; complete installation and demonstration service.
This machine is readily adaptable for optional tape control of automatic feed cycle; depth selection from six pre-set stops; tool change indicator.

CINCINNATI LATHE AND TOOL CO.
CINCINNATI 9, OHIO
HYDRASHIFT Lathes / CINCINNATI Drilling Machines / SPIROPOINT Drill Sharpener
CINTIMATIC Numerically Controlled Lathes and Drills

Tool Steel Topics

BETHLEHEM STEEL

Another report on Air-4 tool steel

Blanking and embossing this automotive part, from coiled steel of .125 in. thickness and doing it at substantial speed, is all in a day's work for Bethlehem Air-4 tool steel . . . at Melrath Metal Stamping Corp., Red Hill, Pa. Tool engineers at this plant have several good reasons for giving a good report on Air-4: they like the ease with which it can be machined . . . its simple heat-treatment, and above all, they admire its wear-resistance. Hardened to Rockwell C-60, the die undergoes slight redressing every 100,000 strokes of the press.

HARDENS AT LOW TEMPERATURE

Air-4 is a free-machining, medium-alloy tool steel which hardens in air—at about 1550 F. It has excellent free-machining characteristics because of a lead addition. It also has excellent wear-resistance and high toughness, and is deep-hardening to assure long tool life.

Air-4 is a versatile tool steel. Why not place an order right now for a trial bar, and use it in an experimental run? Your Bethlehem tool steel distributor can give you prompt delivery.

Bethlehem Tool Steel Engineer Says:

Always Heat-Treat the Tool Instead of the Thermocouple

Many tool failures can be attributed to the use of improper temperatures during heat-treatment. In many instances, although the thermocouple chart may have indicated proper heat-treatment temperatures, the microstructure of the tool shows that the recorded temperatures were not attained by the tool. This is called "heat-treating the thermocouple, instead of the tool."

It is easy to see why such errors occur, for the thermocouple indicates the temperature at the location of its tip only. Most furnaces have some non-uniformity of temperature. For example, locations near the source of heat are hotter than remote locations. And the bottom tends to be colder than the top. An operator who is on the ball will survey his furnaces to determine what temperature differences are present. This will assist him in selecting the location which will provide the most accurate indication of the temperature of tools heated in each furnace. It will often indicate that more than one thermocouple is needed.

Where a temperature survey is not feasible, the tip of the thermocouple should be placed as near the tools as possible. But avoid locations near the floor, sides, roof, or near the source of heat. Although the thermocouple is accurate, and highly useful, it's by no means foolproof.

FOR THE COMPLETE

GIDDINGS & LEWIS

. . . first in machine tools specifically designed and manufactured for numerical control.

Horizontal boring, milling, and drilling machines — table, floor, and planer types — 3″ to 14″ spindle diameters — positioning or contouring control.

Vertical boring and turning machines — 32″ to 20′ table sizes — positioning or contouring control.

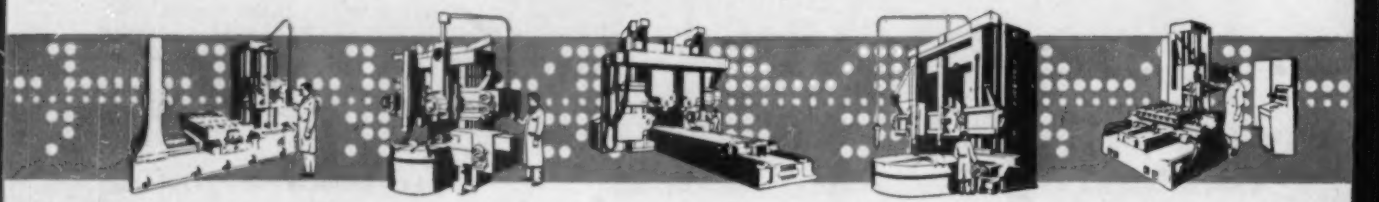
Jig borer and milling machine — combines heavy milling capacity with precision positioning under Numeripoint control.

DiMil and Variax horizontal contour milling machines — 2, 3, 4, and 5-axis — Numeripath controlled.

Planer mills — 36″ to 144″ table widths standard — positioning or contouring control.

Radial and precision drilling machines — with 2-axis Numeripoint control positioning tables — sizes to suit job requirements.

Call your Giddings & Lewis distributor or write for literature.



CIRCLE 217 READER SERVICE CARD

TAPE CONTROL "PACKAGE"

Machines. A complete new line designed and built to be operated under numerical control — horizontal boring, drilling, and milling machines . . . vertical boring and turning machines . . . combination jig borer-milling machine . . . contour milling and die sinking machines . . . positioning tables . . . planer mills.

Controls. The system of your choice, including Numeripoint* and Numeripath* controls of G&L design and manufacture to give you maximum productivity in point-to-point positioning or path machining, plus guaranteed responsibility vested in a single supplier.

Tape control training. G&L trains your operators when the machine is installed, teaches existing personnel how to program and prepare tapes, provides in-plant instruction of your maintenance men and conducts service training schools at Fond du Lac.

Reference material. Programming and control manuals thoroughly explain the equipment and procedures.

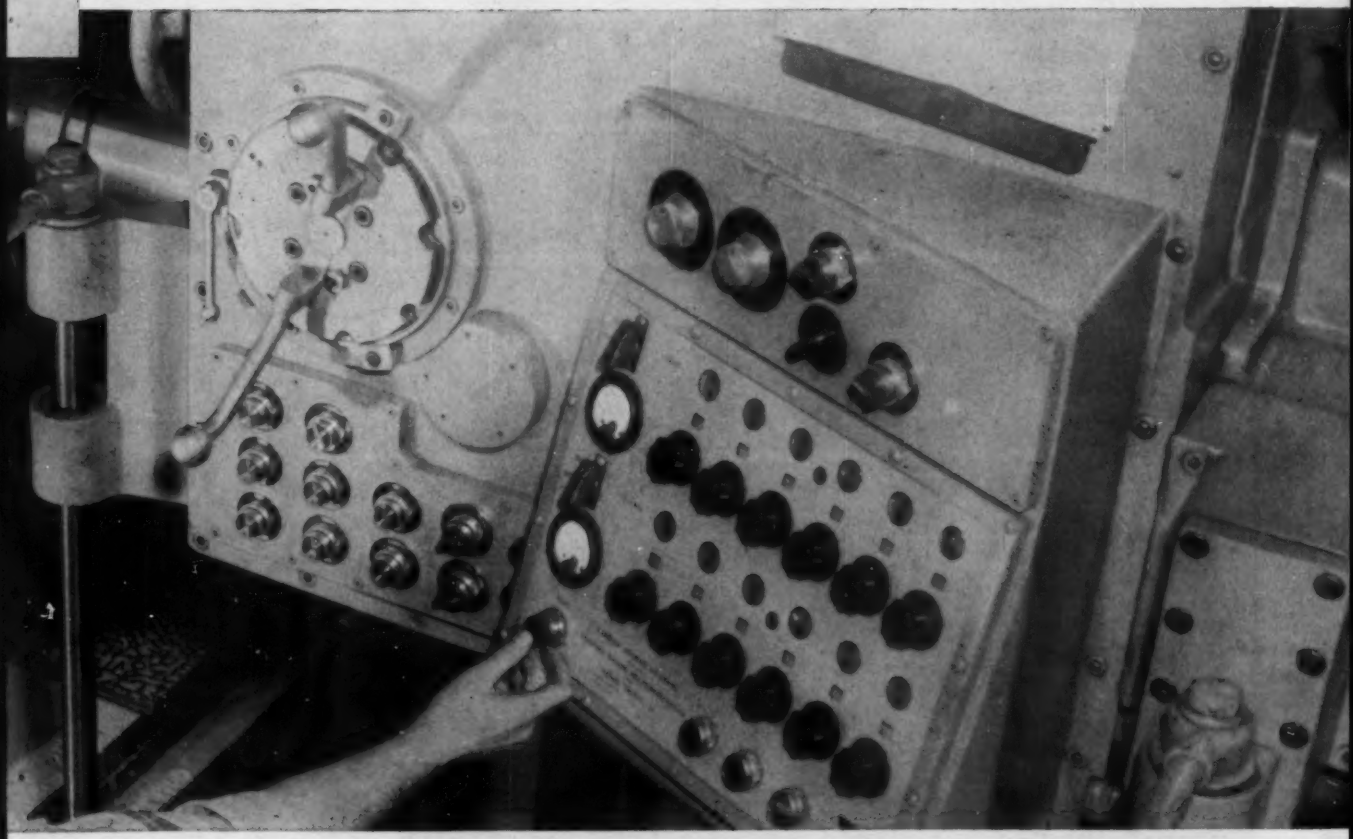
Cutting tools and toolholders. Davis pre-size VBM and VTL tooling . . . boring tools . . . arbors, sleeves . . . continuous-feed facing heads . . . tapholders for machines without thread leads . . . and special tools.

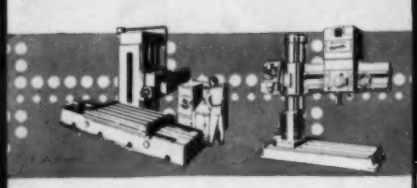
Accessories and attachments. Rotary tables, angular milling attachments, box-type angle plates, V-blocks, stop and jack blocks, measuring devices, and other equipment for speeding setups and production.

Consultation. Giddings & Lewis built the first commercially available tape-controlled machine tool, has shipped more types of major machines with numerical control than any other builder, uses tape control extensively in its own shops. This experience is available to help you justify, select, and apply numerically controlled machines for maximum manufacturing and economic benefits.

Ask for details and literature.

*Giddings & Lewis trademark





GIDDINGS & LEWIS

GIDDINGS & LEWIS

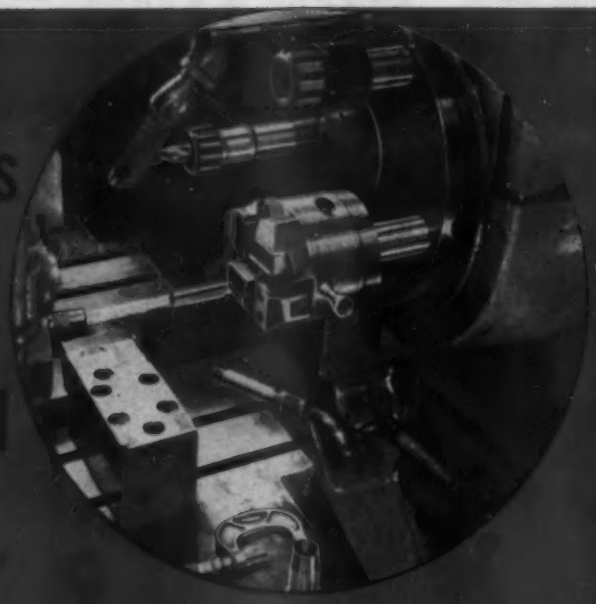
GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wisconsin

Jig borer and milling machine; horizontal boring, drilling, and milling machines; vertical turret lathes; vertical boring mills; positioning tables; die sinking machines; contour milling machines; radial and upright drilling machines; planers; planer mills; numerical and tracer control systems; Davis boring tools.

T61-1

CIRCLE 218 READER SERVICE CARD

LANDIS chasers last 6 times longer than form tool



A Landis 1½" FD LANDMATIC Die Head equipped with Landis Tangential Chasers is shown threading nipples at the Pershing Machine Company, Jackson, Michigan. Chaser life is 6 times longer than that of the form tools used.

The LANDMATIC Die Head is mounted on a 2½" AB Cleveland Diamatic Machine and produces 1-1/16" diameter, 18 pitch NEF, Class 2 threads 1" long on Monel metal.

The form tools produce only 15 pieces between grinds and the drills, also used in this operation, produce 100 pieces. Besides having a much longer chaser life, the LANDMATIC Head produces 100 pieces between grinds equalling the drill life. The LANDMATIC Head also produces excellent thread finish and size control.

The Standard F LANDMATIC is a self-opening, manually-closed, heat-treated die head for application to turret lathes, hand screw and automatic screw machines, cracking machines and other equipment using a nonrotating type tool. However, when the tool is to be placed on automatic equipment where automatic closing is required, such as in the operation at Pershing Machine Co., the FD LANDMATIC incorporating overtravel is recommended. The FD LANDMATIC can be cam-closed through special closing pins or closing bushings. This overtravel feature eliminates the need for a complicated, accurately-set closing cam.

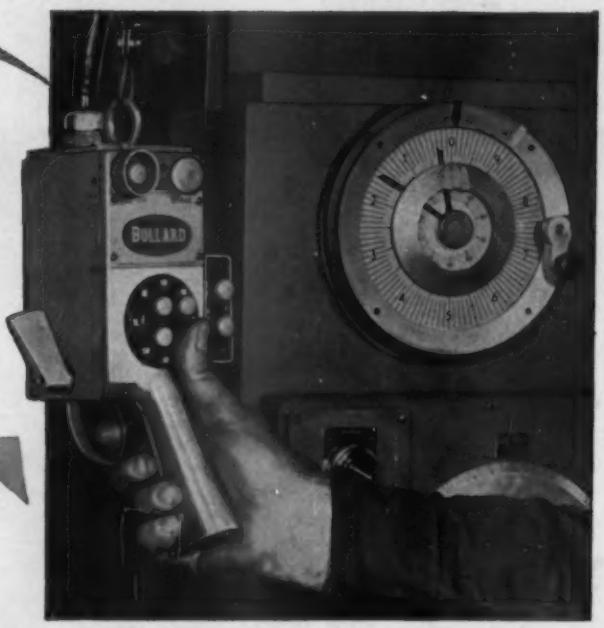
For complete information on LANDMATIC Die Heads, please request Bulletin L-90.

LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA
The world's largest manufacturer of threading equipment

604C

Lower Costs — Increase Profits with

CENTRALIZED POWER CONTROL



..... on the BULLARD DYNAMILL* H.B.M.

Large, easy to read clock-type dials allow the operator to "power" position the head, table, saddle and spindle in relation to the work piece without the use of hand cranks or levers. These dials, when the machine is equipped with numerical control, provide an accurate, instantaneous visual read-out on the positioning of the system.

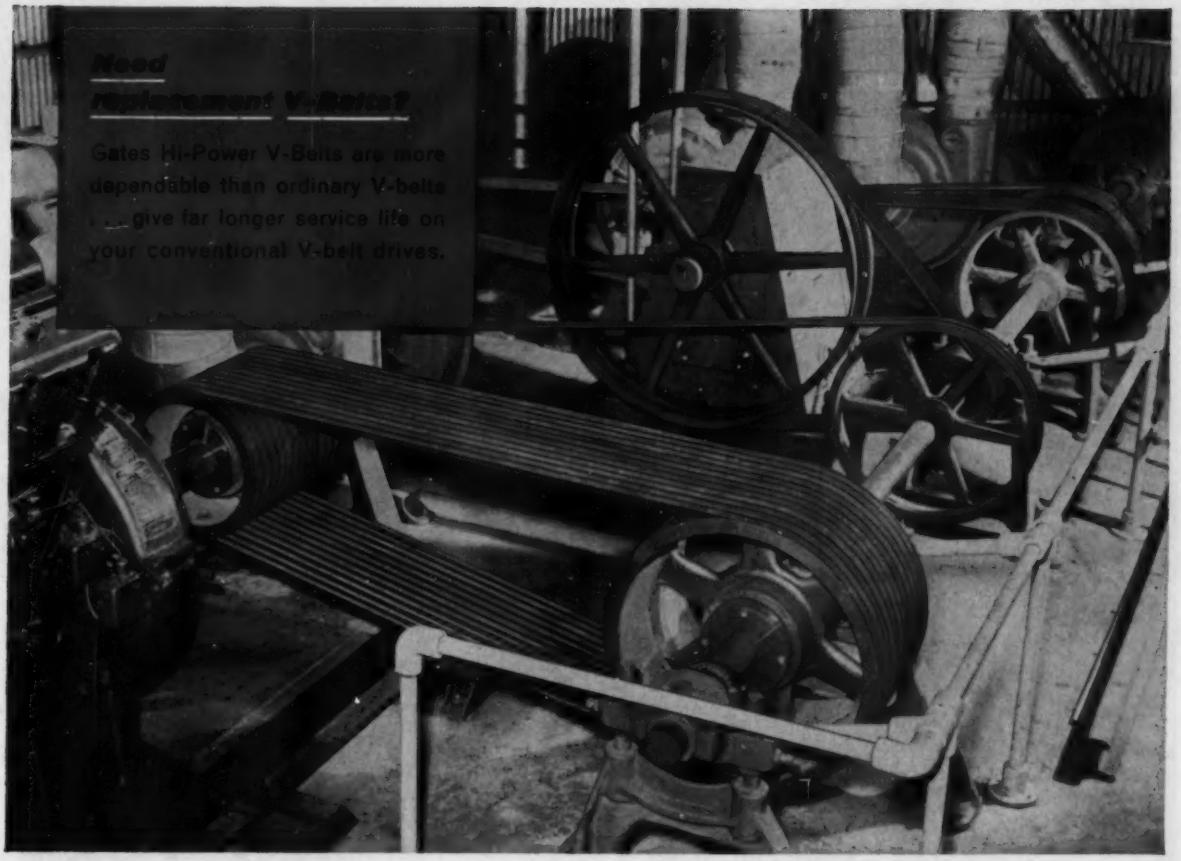
Simple push buttons on the control pendant direct all motions of the head, table, saddle and spindle. Spindle start and stop, as well as spindle speed changes, are controlled from buttons on the pendant. Four traverse rates and feed engagement are actuated by the operator's forefinger on the pendant trigger.

Thus, within the span of a man's hand, are centralized power controls which allow the operator to keep the tool in the cut more of the time — thereby reducing costs and increasing profits.

For Complete Information,
ask your nearest Bullard Sales Office for a catalog or write to

*Trade Mark

THE BULLARD COMPANY • BRIDGEPORT 9, CONNECTICUT


Need
replacement V-Belts?
Gates Hi-Power V-Belts are more dependable than ordinary V-belts . . . give far longer service life on your conventional V-belt drives.

Why Gates Hi-Power V-Belts are industry's No. 1 choice for replacement belts

There are several important reasons why Gates Hi-Power V-Belts are preferred by most industrial V-belt users today.

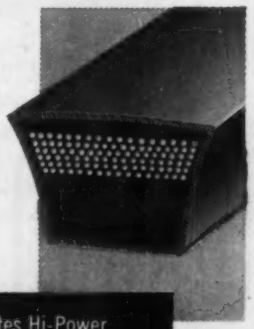
The exclusive construction features of Gates Hi-Power V-Belts—Concave Sides (U.S. Pat. No. 1813698), Precisely-Engineered Arched Top, Flex-Bonded Tensile Member—make them more dependable than ordinary, conventional V-belts, giving you far longer belt life on even the toughest applications.

Moreover, because of Gates high standards of quality control, you get a perfectly matched set of Hi-Power V-Belts every time—every belt pulls its share of the load throughout the long service of the drive, further increasing belt life.

You get fast delivery from local stocks.

Gates Distributors, located in all parts of the country, have large stocks of Hi-Power V-Belts on hand, backed by Gates Service Centers in every major industrial area. This means that you can get replacement V-belts quickly, day or night—reducing to a minimum costly production down-time.

The Gates Distributor near you is a dependable source of supply for most of your maintenance needs. Call him for fast delivery of Gates Hi-Power V-Belts.



The Gates Rubber Company, Denver, Colorado BP 49

Gates Hi-Power V-Belts

COOL CUTS

Keeping close tolerances is of prime importance at Diagraph-Bradley Industries, Inc., of Herrin, Illinois, leading manufacturer of stencil machines and accessories. One of the ways this is accomplished is by keeping cutting edges cool.

At Diagraph-Bradley stencil punches must be cut and held within .0005 of an inch—a fine point of precision Diagraph-Bradley attributes to the cooling and lubricating effect of Cities Service Chillo 10 cutting oil.

"You have only to take a Diagraph-Bradley machine," says one of the company officials, "cut a stencil with it and look at the resulting letter to realize how important the right cutting oil is to our production."

Cities Service Chillo 10 oil is a sulphochlorinated oil. The concentrations of sulphur and chlorine are stabilized by a special process, assuring uniformity of action through the entire cutting operation.

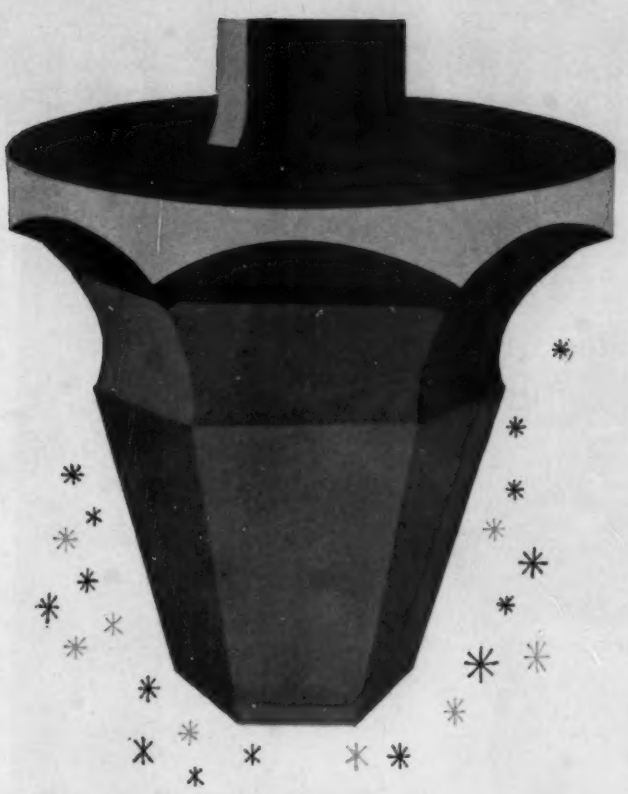
That's why, with Cities Service Chillo 10 cutting oil, work is always more accurate, clean and cool!

For full information call your nearest Cities Service office or write Cities Service Oil Company, Sixty Wall Tower, N.Y. 5, N.Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

New guide to the right electrode materials for electrical discharge machining



You'll find many answers here, in the new bulletin on Mallory electrode materials for electrical discharge machining. It's your guide to:

Selection of Mallory electrode materials—Sparkonite® materials: long wearing, easily machined and brazed; Elkonite® non-annealing materials for exceptional wear, close tolerances, intricate contours.

Electrode performance—comparative data on wear ratios, metal removal rates, resistance to edge breakdown.

Physical properties—conductivity, hardness, strength, machinability.

Get this useful information by sending us the coupon below. And for Mallory electrode materials for EDM—in bar stock or shaped to specifications—see your nearest Mallory welding distributor, or write to Mallory Metallurgical Company . . . a division of P. R. Mallory & Co. Inc.

SEND FOR THIS VALUABLE NEW GUIDE ON ELECTRODE MATERIALS FOR EDM

P. R. MALLORY & CO. Inc.
MALLORY

Mallory Metallurgical Company
P. O. Box 1582
Indianapolis 6, Indiana

Send me your new bulletin on choosing the right electrode materials for EDM.

NAME_____

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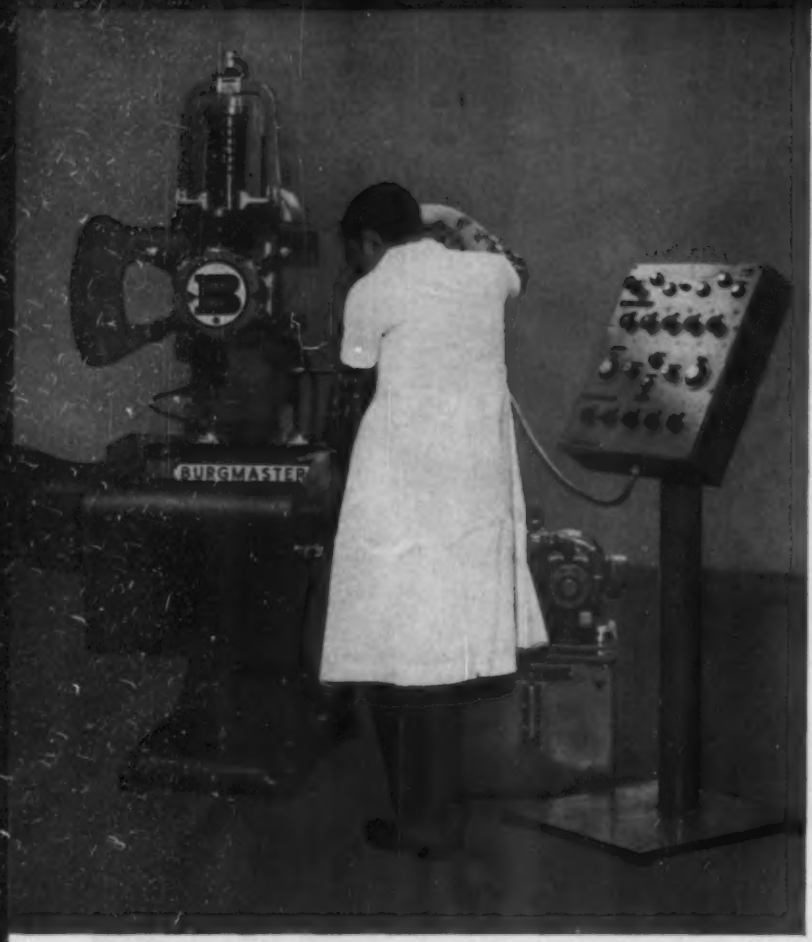
CITY_____ STATE_____



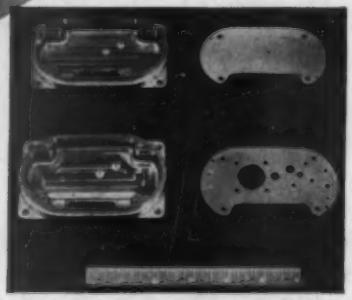
Tool costs are reduced 75% in the machining of Gear Housings at Autonetics on a Burgmaster 2BHT TAPE CONTROLLED Turret Drilling, Tapping and Boring Machine. Savings result from the elimination of expensive jigs and fixtures otherwise needed to conventionally drill, tap and mill three basic shapes of the Gear Housings, each up to 13 different hole patterns.

The present inexpensive setup on the Burgmaster Turret Drill consists of a work-holding subplate and standard clamps. Low cost tooling, plus the speed and ease of changing jobs, makes small lot production economical. At Autonetics, lot sizes are usually less than 25 parts. The twin setup illustrated on the Gear Housing enables the operator to perform loading and unloading operations while one part is being machined. He can also attend several machines since all machining is automatic.

The Machine Sets the Pace at automatic speed and repeatability. All machine functions are controlled by the tape which simultaneously positions the work on the X-Y axis at 150"/min. and selects the proper spindle.

SEQUENCE OF OPERATIONS

	Spindle No.	Oper'n or Tool (Dia.)	Speed	Depth	Number of Holes
Tape #1	1	#2 C'Drill	3000		All
	2	#1 C'Drill	2000		All
	3	⅛ Drill	1300	⅜ thru	7
	4	#43 Drill	3000	⅜ thru	2
	5	#50 Drill	2000	⅜ thru	2
	6	2-56 Tap	450	thru ⅜	2
Tape #2	1	#37 Drill	3000	⅜ thru	1
	2	¼ End Mill	2000	.922	2
	3	4-40 Tap	450	thru ⅜	2
	4	⅜ Drill	3000	⅜ thru	1
	5	¼ Drill	2000	⅜ thru	1
	6	13/64 Drill	450	⅜ thru	1



GEAR HOUSINGS BEFORE AND AFTER MACHINING
Autonetics produce these parts in three cast shapes, each with up to 13 hole patterns. The Insert Plate (right) is assembled on top the Gear Housing Base prior to machining, with two dowel pins providing close assembly register. 57 machining operations are performed on 17 holes to close tolerances without jigs.

Frauenthal reports NEW VERSATILITY

Why Burgmaster Turret Drills Are the World's Most Popular Tape Controlled Machine Tool

In less than three years since the introduction of Burgmaster TAPE CONTROLLED Turret Drilling Machines, over 175 have been installed throughout industry. This represents the largest number of unit installations of any tape controlled machine tool.

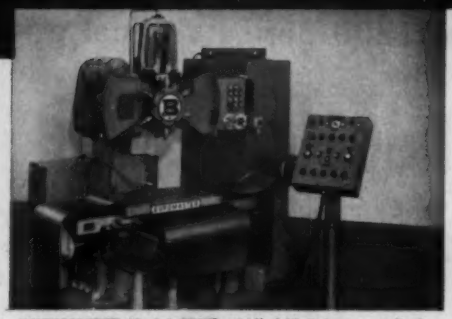
In this short time, over 30% of the initial installations have been followed by repeat orders. Sample comments received from Burgmaster users are significant:

. . . "This is the fastest and cheapest method we know to produce parts requiring drilling, reaming, tapping and associated hole machining operations."

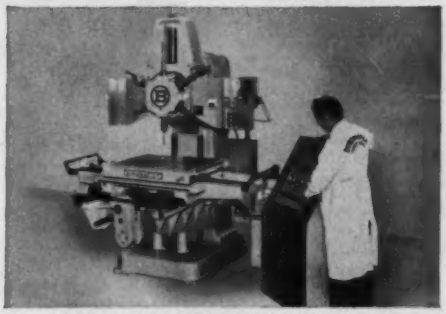
. . . "Engineering changes which would take a week or more for fixture modifications required by conventional machining methods can now be made during the same shift, and often within less than an hour."

. . . "A considerable amount of additional savings results from reduction in inspection time. It is our practice to inspect the first piece, and have the inspector sign the tape which generally indicates acceptance of future lots in view of the excellent repeatability."

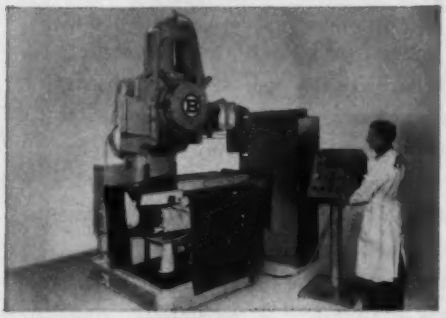
Write for Literature describing the complete line of Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling Machines. Forty minute 16mm sound film showing all Burgmaster Turret Drills in operation is available without charge.



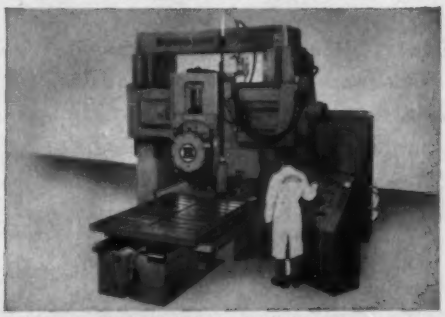
BURGMASTER Model 2BHT—¾" drill & tap capacity in steel. Positioning Table sizes: 10"x18" & 15"x26".



BURGMASTER Model 25AHT—1¼" drill & tap capacity in steel. Positioning Table sizes: 15"x26" & 20"x30"



BURGMASTER Model 3BHT—1½" drill and tap capacity in steel. Positioning Table sizes: 20"x30" & 30"x45".



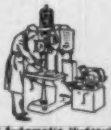
BURGMASTER Model 3BHT-B—1¾" drill & tap capacity in steel. Table Travel 60 x48

"0" Manual Power Index ⅛" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ⅜" Capacity

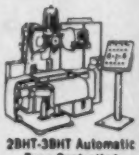
2BR Ram Type Radial Drill ⅜" Capacity



2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity

25AH Automatic Tape Controlled 1¼" Capacity



2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

BURG TOOL

MANUFACTURING COMPANY, INC.
15001 South Figueroa St., Gardena, Calif.
FAculty 1-3510 • DAvis 9-4158

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Plus dealer representatives in other industrial centers.

CIRCLE 226 READER SERVICE CARD

BURGMASTER B

Frauenthal reports NEW VERSATILITY for 1200 Series vertical grinder!

PRODUCTION BY THE THOUSANDS... PRECISION TO THE MILLIONTHS

Now available with NEW tracer control or numerical control... infinitely variable feed and speed ranges!

Frauenthal's flexible 1200 Series single-spindle vertical grinder permits *precision to the last millionth* on contour pieces, yet can be engineered to provide mass production grinding when required.

A new electro-hydraulic tracer control system affords super-precise accuracy. Completely transistorized for compactness and a new high degree of control reliability, the ultramodern tracer system guides the vertical and horizontal axes simultaneously through 360° of motion. Any variation from true contour path is immediately indicated on a continuous recorder which also gives a permanent record of contouring accuracy.

Numerical control allows continuous path or discreet positioning, and is particularly applicable for a variety of grinding operations on a low-cost repetitive basis.

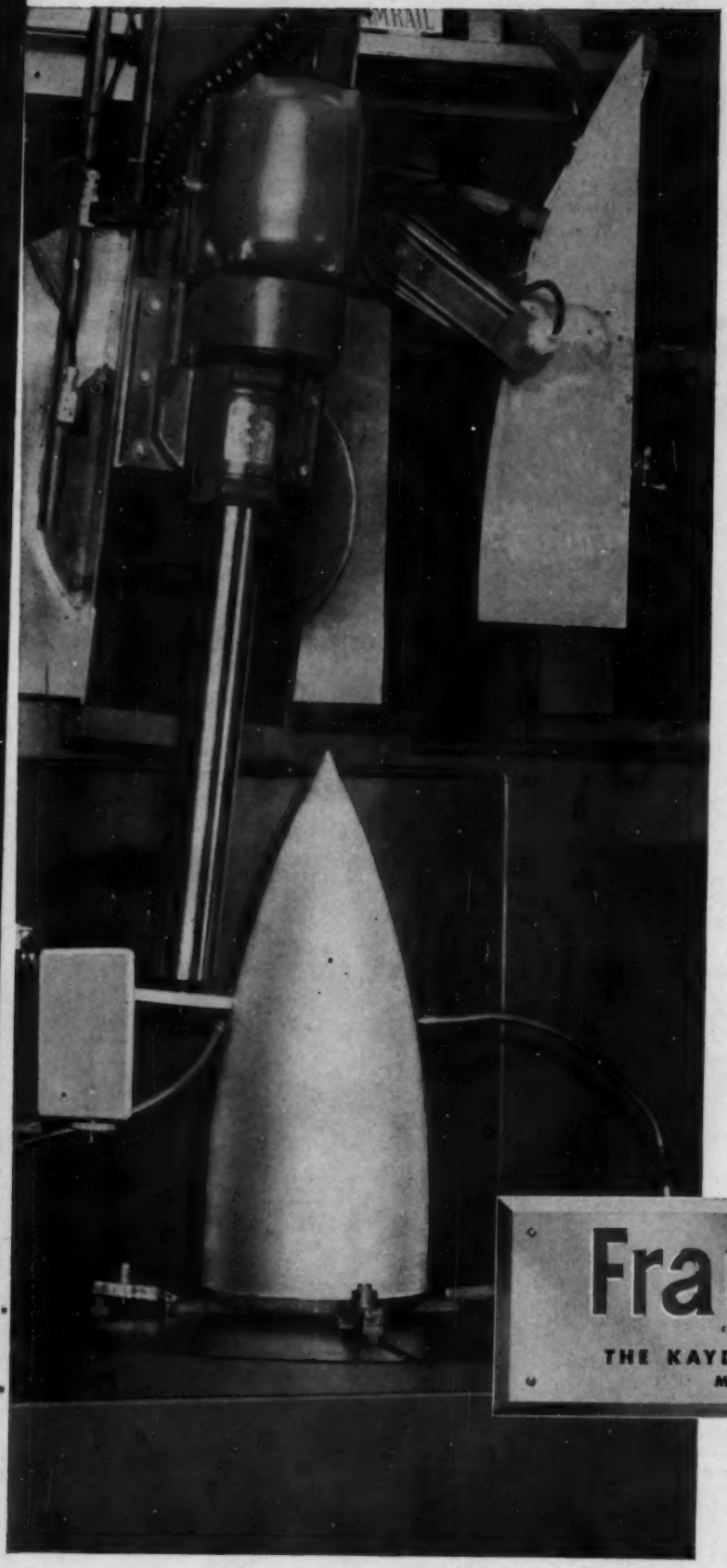
Infinitely variable feed and speed ranges with widest possible working range are available. Direct-current drive with potentiometer control assures accurate variable worktable speed.

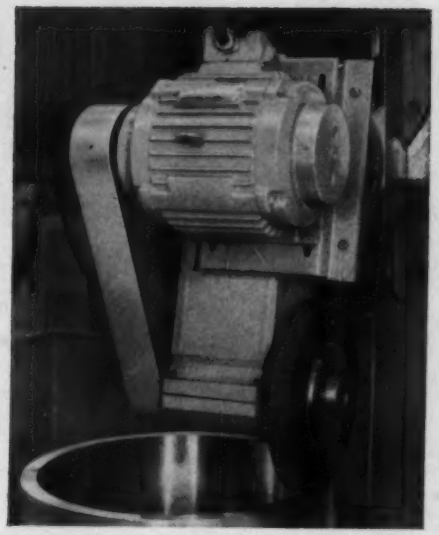
The 1200 Series' vertical design eliminates deflection inherent in horizontal grinders. This design also substantially reduces floor-to-floor time, since parts are loaded easier, centered faster and can be simply, quickly checked.

For complete details on this creatively engineered single-spindle vertical grinder, write for the new Frauenthal 1200 Series bulletin.

There are two 1200 Series models, with table diameters from 24" to 42" and nominal swings of 36" to 48".

CIRCLE 227 READER SERVICE CARD





Here is the right-angle spindle attachment for rotary surface grinding — another new Frauenthal development for use with the 1200 Series grinder.

Designed and built in the U. S. A. You get American quality when you buy Frauenthal.

Frauenthal

DIVISION

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN, U.S.A.

Republic helps you

MATCH THE MATERIAL TO THE JOB

To help cut costs, improve your product quality, meet close-tolerance design requirements . . . you can count on Republic.

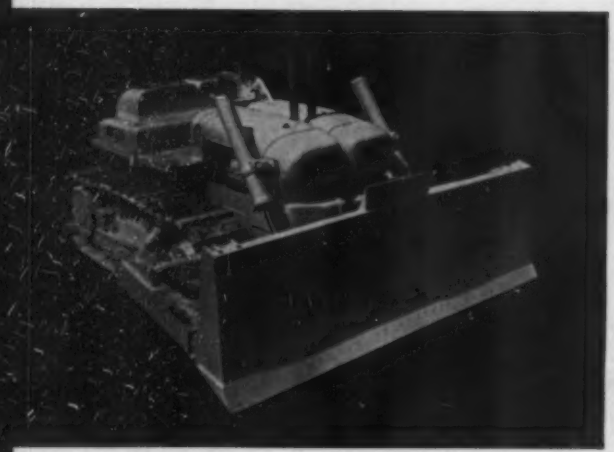
Republic . . . where diversified capabilities, modern facilities, and engineering know-how all add up to one important fact: Republic produces the world's widest range of standard steels and steel products. *Steels and products to exactly match your job requirements.*

And to help you in the selection of the best, lowest cost material for your requirements, specialists from each Republic Division (metallurgists, engineers, designers) are at your service to work with you and your staff. It's an obligation-free service of

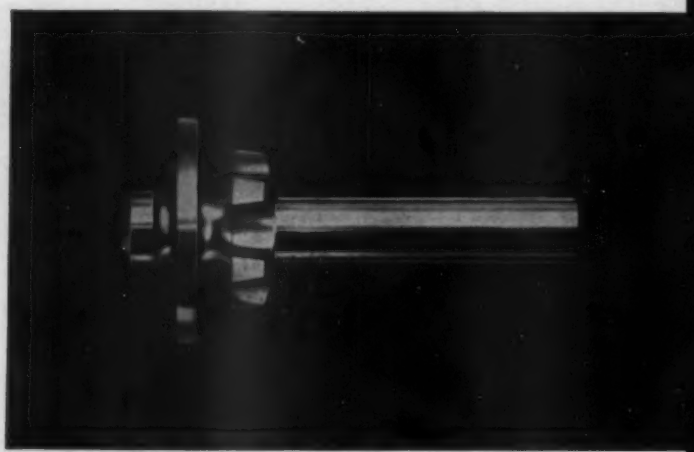
REPUBLIC STEEL

General Offices • Cleveland 1, Ohio

World's Widest Range of Standard Steels and Steel Products

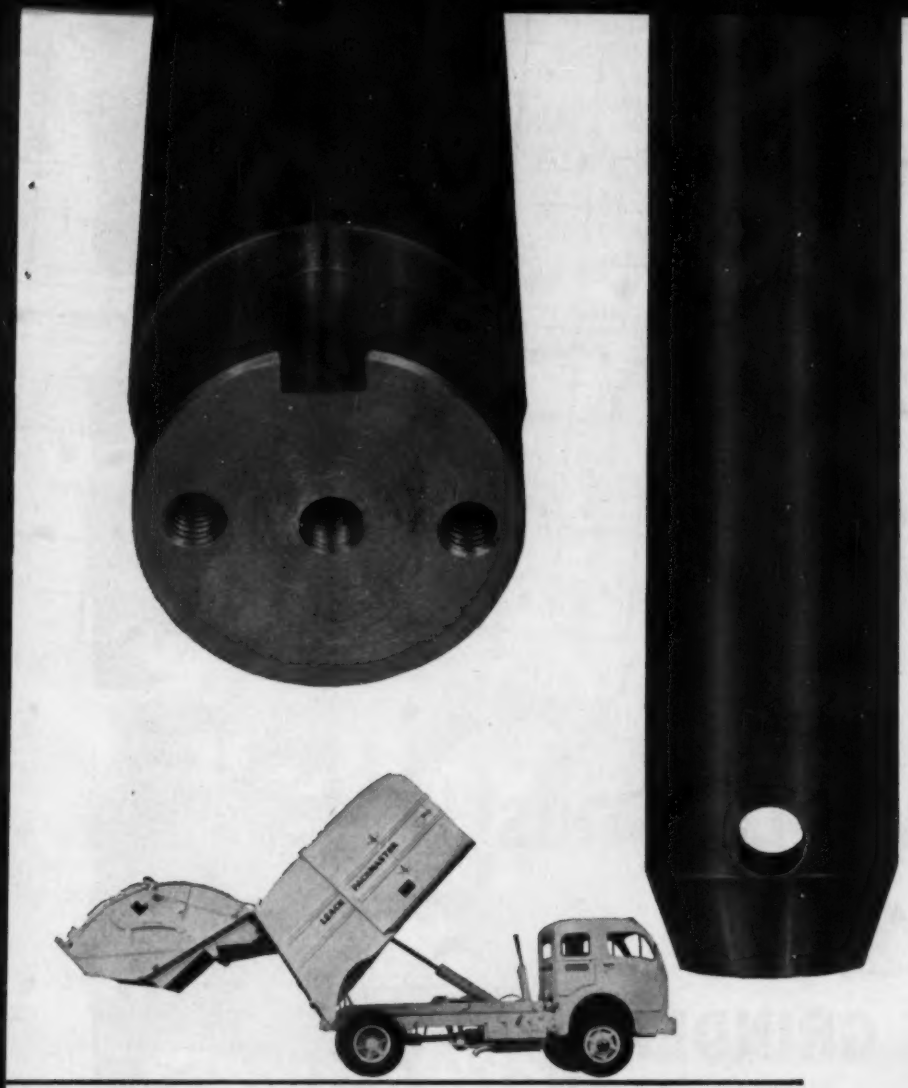


SPECIAL SECTIONS for a dozer. Uniformly high impact- and wear-resistance are musts for grader and bulldozer blades. Bucyrus Blades, Inc., Bucyrus, Ohio, found this combination in a special analysis Republic Hot Rolled Steel. Costs are rock bottom, too, because the steel is Republic-rolled into special sections that trim finishing and forming costs for Bucyrus. Check into Republic Special Sections for your product by mailing the attached coupon.

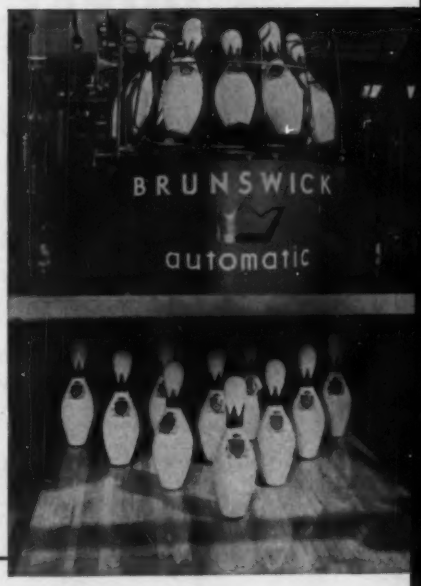


STAINLESS to beat corrosion and wear. In the manufacture of Hyseal Valve Stems for American-Standard single lever mixing faucets, National Acme Co., Cleveland, required steel with high corrosion- and wear-resistance, plus easy machinability. Material selection: Republic Cold Finished Stainless Steel Bars—Type 303. Completed in a single setup, the 10 machining operations—including multiple end drilling of six holes on a 15° angle—are performed in 12 seconds. Send coupon for information on Republic Stainless for your job requirements.

CIRCLE 229 READER SERVICE CARD



COLD FINISHED ALLOY BARS form high strength pins. The full weight (up to 5 tons on larger units) of the Packmaster body and its refuse load, rests on steel pins at the pivot points when the unit is hoisted to unload. Republic Cold Finished Alloy Bars, cut off, drilled, and chamfered by the Packmaster Manufacturer, Leach Co., Oskosh, Wisconsin, offer the toughness and abrasion resistance needed for this application. Investigate the advantages of using Republic Cold Finished Alloy Bars for your component parts production by sending the coupon below.



Steel

Strong,
Modern,
Dependable

ELECTRUNITE Mechanical Tubing to meet close tolerances. Automatic pinsetters—product of Brunswick Corporation—are precision-engineered, rugged mechanical units. Republic ELECTRUNITE Tubing was specified for use in three key locations because it met the extreme tolerance requirements; reduced weight without sacrificing strength; and is delivered ready for fabrication, saving production time and costs. Send for data on the complete selection of ELECTRUNITE sizes, gages, and wall thicknesses.

REPUBLIC STEEL CORPORATION
DEPT. AM-1898
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:
- ☐ Republic Special Sections
- ☐ ELECTRUNITE® Mechanical Tubing
- ☐ Cold Finished Stainless Steel Bars
- ☐ Cold Finished Alloy Bars
- ☐ Metallurgical, Machining, Design Service

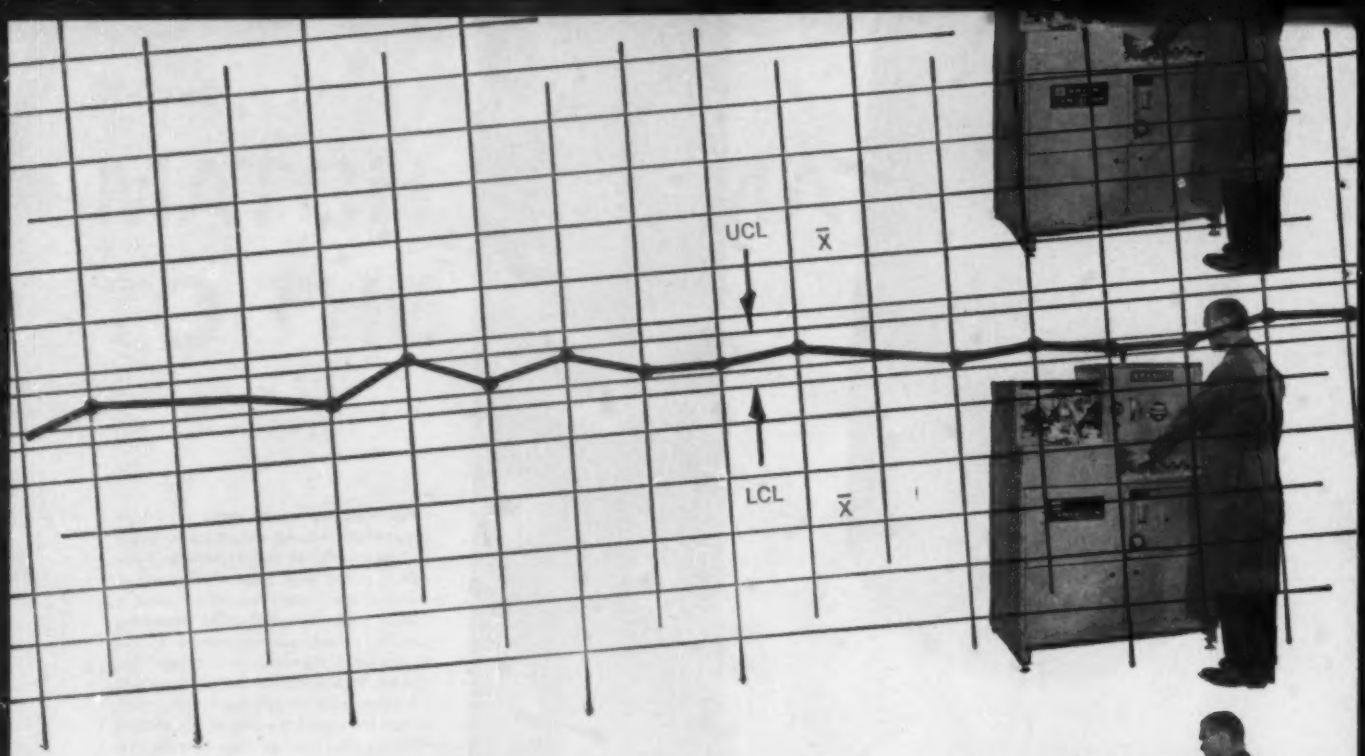
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

CIRCLE 230 READER SERVICE CARD



TEST CURVES LIKE THIS PROVE OUT BRYANT GRINDERS

The test curve above is typical. It shows the average size variation of the I.D. in a run of sample parts ground to customer specifications on a Bryant Internal Grinder. From this curve and other data, Bryant engineers evaluate the machine's *long term* precision capabilities, using mathematical laws of probability. Result: a job-engineered machine, tested under actual production conditions — *proved out* by statistical quality control methods. Logical reasons why a Bryant Production Internal Grinder is best suited to maintain the required quality standards in *your* plant. Contact your nearest Bryant or Ex-Cell-O sales representative for full details.

This Model "B" Centalign® provides quick changeover and high precision on short or long production runs of small workparts.

BRYANT

Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT, U.S.A.

Internal Grinders • Special Machinery

CIRCLE 231 READER SERVICE CARD

NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW!

The blades that outlast all others!

A RADICALLY NEW METALLURGICAL APPROACH builds unprecendented durability into Heller "Ultras". That's why they're certain to outlast all high speed steel band saws currently used in production cut-off work on ferrous metals. **IMPROVED IN EVERY WAY!** Special steel analysis . . . more advanced production methods . . . closer heat-treating control . . . stronger welds . . . more exacting 100% inspection! No wonder Heller "Ultras" deliver up to 300% more cuts per blade. Yet, the price is only 10% higher. This means as much as 75% savings in cutting costs. **TESTS CONFIRM THEIR SUPERIORITY!** Matched against all comers, at heavy feeds and higher speeds, the harder teeth, tougher bodies and more uniform full-blade flexibility of Heller "Ultras" are sure bets to win the race against time and costs. Seeing's believing!

Heller

"ULTRA"
HIGH SPEED STEEL
metal cutting
BAND SAWS

INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION

TAKE THE GAMBLE OUT OF BUYING!

An early order for welded-to-length, protectively packaged Heller Ultra High Speed Steel Band Saws from your nearby Heller Distributor is the wisest and safest bet you'll ever make. Prompt delivery is also guaranteed!

HELLER TOOL CO. SINCE 1836

17.0.17

HELLER TOOL CO.
Our 125th year 1836-1961

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

Branch Offices and Warehouses: Union, N. J. • Detroit • Chicago • Shreveport • Los Angeles • San Francisco • Portland, Oregon

Armco 17-4 PH Stainless cut cost of this

This body housing for a high pressure hydraulic coupling device was formerly made of SAE 4140 steel. By switching to 17-4 PH and making full use of its high strength, excellent fabricating characteristics, and low temperature heat treatment, total cost of the part was slashed 52 per cent.

How It Was Achieved

Key to this impressive cost reduction is the *single* low temperature heat treatment required for Armco 17-4 PH Stainless. Only one hour at 900 F creates the hardness (Rockwell C 38-42) and strength required. Because this produces no harmful distortion or scaling, the part can be completely machined before hardening. Heat treatment is simpler and cheaper than for the 4140 steel formerly used. Armco 17-4 PH also simplifies shop routing and eliminates two machining set-ups.

Another important advantage of switching to 17-4

Get Armco 17-4 PH and other Armco Stainless Steels from these Steel Service Centers

Steel part 52%!

For Strength, Durability and Economy

PH is a *90%* reduction in rejects. This not only contributes to lower costs but increases production as well. Excellent corrosion resistance of Armco 17-4 PH eliminates nickel plating needed to protect the 4140 steel part.

Opportunities For You

If you are making parts that must be hard, strong, and corrosion resistant, Armco 17-4 PH Stainless Steel offers many opportunities to cut production costs and improve product performance as well. It is doing so for manufacturers of a wide range of products.

For additional data on how Armco 17-4 PH has cut costs as much as 52% and a booklet describing its properties and applications, write us or contact your Distributor of Armco Stainless Steels. Armco Division, Armco Steel Corporation, 1511 Curtis Street, Middletown, Ohio.

(A) Sheets, Strip and Plates (B) Bars and Wire

AMERICAN STEEL & ALUMINUM CORP. Hartford, Conn.	(AB)
AMERICAN STEEL & ALUMINUM CORP. OF MASS. Cambridge, Mass.	(AB)
BROWN-WALES COMPANY Cambridge, Mass.—Auburn, Maine—Worcester, Mass.	(AB)
CENTRAL STEEL & WIRE COMPANY Chicago, Ill.—Cincinnati—Detroit—Milwaukee	(AB)
CHICAGO STEEL SERVICE COMPANY Chicago, Ill.	(AB)
CLEVELAND TOOL & SUPPLY COMPANY Cleveland, Ohio	(B)
THE CONGDON AND CARPENTER COMPANY Providence, R. I.—Fall River, Mass.	(AB)
C. A. CROSTA, INC. Denver, Colo.	(A)
DUCOMMUN METALS & SUPPLY COMPANY Los Angeles, Calif.—Berkeley—Phoenix—San Diego—Seattle	(AB)
EDGCOMB STEEL & ALUMINUM CORP. Hillside, N. J.	(AB)
EDGCOMB STEEL COMPANY Philadelphia, Pa.—Charlotte, N. C.—Greensboro, N. C.—York, Pa.	(AB)
ESCO CORPORATION Portland, Oregon—Denver—Emeryville, Calif. Eugene, Oregon—Los Angeles—Seattle Spokane—Vancouver, B. C.	(AB)
PETER A. FRASSE & COMPANY, INC. New York, N. Y.—Buffalo—Hartford—Lyndhurst, N. J.—Philadelphia—Syracuse	(AB)
FIRTH BROWN STEELS LTD. Montreal, P. Q.—Toronto	(AB)
GATE CITY STEEL, INC.—OMAHA Omaha, Nebr.	(A)
INDUSTRIAL STAINLESS STEELS, INC. Cambridge, Mass.—Buffalo, N. Y.	(B)
EARLE M. JORGENSEN COMPANY Los Angeles, Calif.—Dallas—Denver—Houston—Oakland—Phoenix—Seattle—Tulsa—Wichita	(AB)
MAPES & SPROWL STEEL COMPANY Union, N. J.	(AB)
METAL GOODS CORPORATION St. Louis, Mo.—Dallas—Denver—Houston—Memphis—New Orleans—N. Kansas City, Mo.—Tulsa—Wichita	(AB)
MONCRIEF-LENOIR MFG. COMPANY Houston, Texas—Dallas—Harlingen—Lubbock—San Antonio—Temple	(AB)
MORRISON STEEL COMPANY New Brunswick, N. J.	(AB)
THE ORLEANS STEEL PRODUCTS COMPANY, INC. New Orleans, La.	(A)
WILLIAM M. ORR COMPANY, INC. Pittsburgh, Pa.	(AB)
PAPER-CALMENSON & COMPANY St. Paul, Minn.	(A)
RICHARDS & CONOVER STEEL & SUPPLY COMPANY Kansas City, Mo.	(A)
SEABOARD STEEL & IRON CORP. Baltimore, Md.	(B)
SENECA STEEL SERVICE, INC. Buffalo, N. Y.	(AB)
SOUTHER STEEL & ALUMINUM COMPANY St. Louis, Mo.	(A)
J. M. TULL METAL & SUPPLY CO., INC. Atlanta, Ga.—Birmingham—Greenville, S. C.—Jacksonville—Miami—Tampa	(AB)
VIKING STEEL COMPANY Cleveland, Ohio	(AB)
VORYS BROTHERS, INC. Columbus, Ohio	(AB)
YORK CORRUGATING COMPANY York, Pa.—Washington, D. C.	(A)

ARMCO **Armco Division**

Unique new use of special

In manufacturing, fragility and heavy maintenance costs are intolerable. That's why General Electric's F. W. Rueblinger investigated the replacement of milling cutters with diamond abrasive wheels in his arc-quencher finishing operation. As Manager of Manufacturing of G-E's Medium Voltage Switchgear Department, Philadelphia, he was dissatisfied with having to maintain a large inventory of cutters and to keep men working around the clock sharpening and replacing them.

Arc-quenchers are made of a hard and extremely abrasive asbestos compound. This presented such a problem that all but one of the abrasive people consulted threw in the sponge. The one who didn't was Bay State distributor Vince Flynn. He arranged for key General Electric production men to meet with Bay State's Research Staff in Westboro and the problem was examined from every possible angle.

Finally, after extensive development work, Bay State engineered a special 12" diamond wheel that cut fast and maintained the extremely fine tolerances necessary in the finishing of these important parts of Metal-clad Switchgear.

With as many as 136 wheels on a single arbor simultaneously making ¼" deep cuts, the problem of driving power alone could have been disastrously troublesome. However, the wheels Bay State developed cut so easily that it was possible to increase the feed rate nearly 400% . . . and overall productivity went up a good 50%!

On top of these already proven advantages, wheel life is estimated at three full years so the constant down-time problems that used to arise from the need for cutter maintenance is entirely a thing of the past.

This outstanding success is not the end of the story. Now that General Electric's man-made diamonds are available for metal-bonded wheel applications, Bay State is engaged in intensive research into the even greater application potentials of this material.

Whether you have an unusually complex problem, or are simply trying to pare down costs, you'll find your Bay State distributor or direct representative is both hard-working and thoroughly experienced. *Better grinding at lower cost . . . that is his business.*

Right: Discussing the increased productivity that resulted from grinding, instead of cutting, hard asbestos-composition arc quenchers, are, left to right, Vincent J. Flynn, Bay State Distributor, F. W. Rueblinger, Manager-Manufacturing, John Stabb, Supervisor-Advanced Manufacturing-Engineering, and William A. Siter, Manager-Manufacturing-Engineering.

Below: Two arc-quenchers are shown immediately after passing under a tremendous array of 136 Bay State diamond wheels which have made simultaneous cuts ¼" deep.

diamond wheels ups productivity 50%

Vincent J. Flynn was a Tool & Die Maker at the Frankford Arsenal when World War II came along and he joined the U.S.A.F. With this solid background in practical shopwork, he went into industrial distribution after the war, opening up his own business 5 years ago. Now a highly successful Bay State Distributor, he has this to say about Bay State: "They not only give me and my customers first-class service on routine problems . . . they also roll up their sleeves and dig in every time I come up with a puzzler . . . like this one, for example."

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

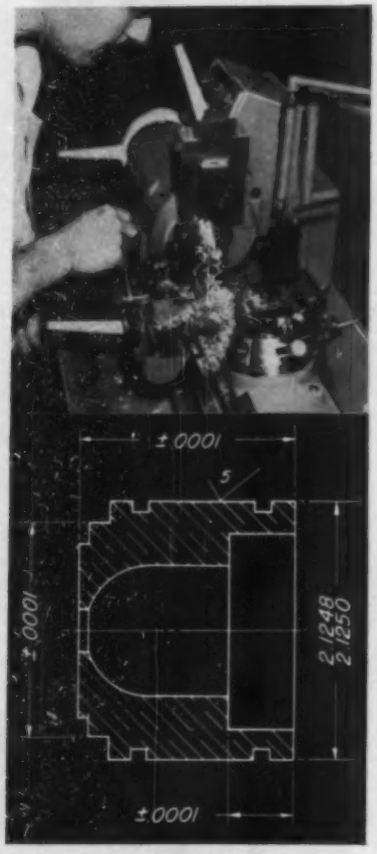
Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

CIRCLE 236 READER SERVICE CARD

Wade

model 98 LATHE

Built with 2¼" collet capacity and 9" swing, this electric clutch hand turret lathe releases large machines from bar work and from second-operation work that can be performed more economically on this size lathe. Perfectly suited, for example, to the type of exacting work that is required on a potentiometer case. Distance from spindle to turret face (max.) 17"; spindle speeds 80 to 2000, infinitely variable.



Can your lathe do this?

- Turn to a √5 finish
- Hold concentricity .0002" on 5 or 6 diameters
- Perform 7 distinct operations at one chucking
- Take 2¼" bar stock through the collets

Send today
for descriptive bulletin

THE WADE TOOL CO.
53 River Street
WALTHAM 54, MASS.

LETTER from the PUBLISHER

An Invaluable Record

The annual show of the American Society of Tool and Manufacturing Engineers (New York Coliseum, May 22-26) comes at a particularly important time. As a manufacturing man, you no doubt find yourself under tremendous pressure to get your unit costs *down*. The cost-price squeeze on profits finds you right in the middle. How well informed you are on the latest cost-cutting techniques in manufacturing can well make the difference between profit and loss for your company.

Important to You . . .

That is why this year's ASTME Show is so important to you. You probably are planning to attend; to see for yourself which new tools, fixtures, tooling techniques and accessories can help you in your business. If you are like others, you will have a limited time in which to see the exhibits you want to see. You won't be able to cover all of them.

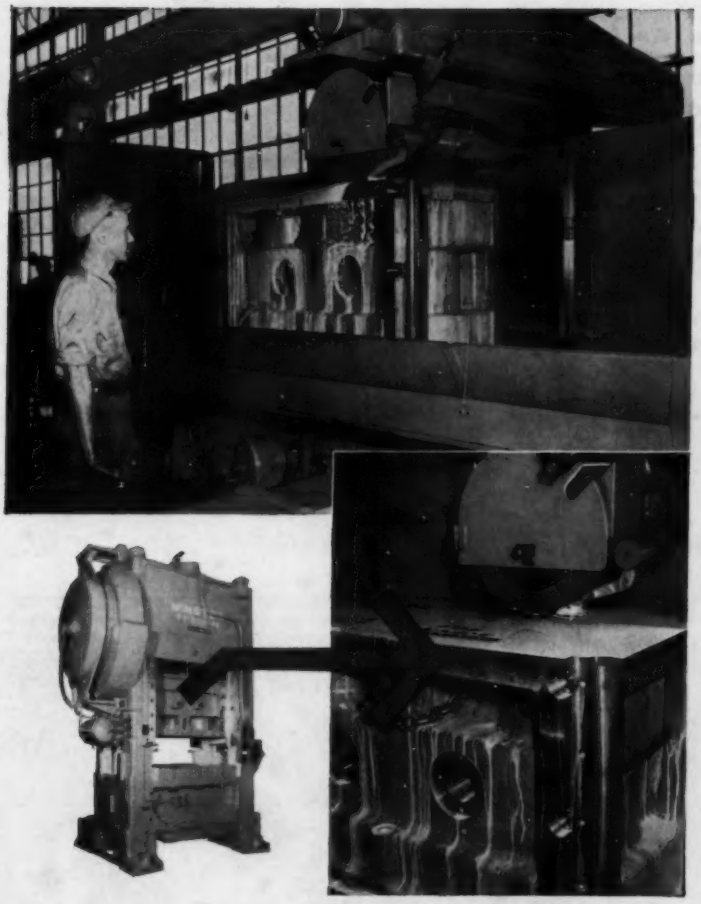
Show in Print . . .

This is where our ASTME Show Issue can help you. We will publish it May 15, 1961, so that you will get it well ahead of the show. It will list all exhibitors, with their booth numbers, and will contain a diagram of the exhibit area as a convenient guide. Most important of all, it will feature the SHOW IN PRINT Section describing every new product to be exhibited. By looking through this section carefully, you can plan exactly what exhibits you really want to see. Related advertising in the issue will give you even more detailed information on product performance. Whether you expect to attend the show or not, you will find this ASTME Show Issue of AMERICAN MACHINIST/METALWORKING MANUFACTURING an invaluable record of current cost-saving new products.

George Reppert

SIZE FOR SIZE

there are no heavier or more accurate surface grinders made than these fast, heavy duty Thompsons



Thompson Type CX heavy-duty surface grinders are designed to grind heavy, massive work pieces. Their stock removal rate is very fast while maintaining extremely close limits of accuracy and microfinish.

Shown here is a Thompson Type CX 30x36x96 machine recently installed in the Minster Machine Company plant at Minster, Ohio. It is grinding the face of the slide for a 200-ton capacity Minster Piece-Maker High Speed Automatic Production press.

The slide is cast iron and weighs approximately 7000 pounds. It is being ground for precise parallelism and to a 20 to 30 RMS finish.

Thompson Grinders have an important part in the production of these world-famous Minster presses. The dependability of Thompson Service and the excellent performance of the Thompson machines now in use at Minster were major factors in the purchase of this latest grinder.

If your production involves the grinding of large, heavy work, it will pay you well to investigate the money and timesaving features of these modern machines.

THE THOMPSON GRINDER CO. Springfield, Ohio

SURFACE GRINDERS

"Keep Thompson in mind for that daily grind"

This edge cuts reaming costs

L+I gives you the edge on production

Call your L+I distributor

The Reamer Specialists

L&I

LAVALLEE & IDE, INC.
CHICOPEE, MASS.

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Misleading

Dear Sirs:
We have read your article titled "Now . . . stainless strip flat within 0.005 in." (*AM/MM*—Oct 31 '60, p90).

The article indicated a first, ". . . as a result of an eight-year development program . . ."

This is not entirely the fact, since Murray-Way recommended the oil grinding process and constructed the first wet abrasive-belt grinding machine in 1948. This was for sheet stock.

The first wet abrasive-belt, continuous grinding line for stainless steel was furnished by Murray-Way Corp to a steel mill in 1950.

We are glad to see that the savings from using the wet abrasive-belt grinding process have been so satisfactory to a user who has had so vast an amount of prior experience in dry grinding.

All Murray-Way wet grinding lines from first to last are designed so that abrasive belt speeds can be varied by the methods you mention and at the same time utilize variable-speed traverse drives.

Incidentally in 1953 Murray-Way constructed the first grinding-to-uniform gage machine (plus or minus 0.0005) using a Sheffield X-ray gage-measuring tool.

The article discusses many facts known in the industry for some time, but which have never been so clearly summarized. You are to be complimented.

R Zech, *secretary*
Murray-Way Corp
Birmingham Mich

We regret that the telegraphic condensation required for our headline conveyed the impression that this new development at Wallingford Steel Co and Behr-Manning Co is also a new development in the industry—Ed.

Glass Die Inserts

Dear Sirs:
We are interested in obtaining more information on the article entitled "Glass Makes Economical Die Inserts," by András Gabór, Budapest, Hungary. (*AM/MM*—Jan 9 '60, p98).

Any further information you

SHOPMATES

N. Jarvis

AT FIRST, IT WAS SO DARK & GLOOMY YOU COULDN'T SEE THE END OF YOUR NOSE
OOPS !! 'SCUSE ME PLEASE !!
SQUONK
SO--- THEY PUT IN A FEW LIGHTS --- AND A FEW MORE LIGHTS --- AND --- SO WHAT'S NEW ?
THAT YOU BERT ??
N. JARVIS

Statistical control is not enough
to meet today's demands for greater accuracy . . .

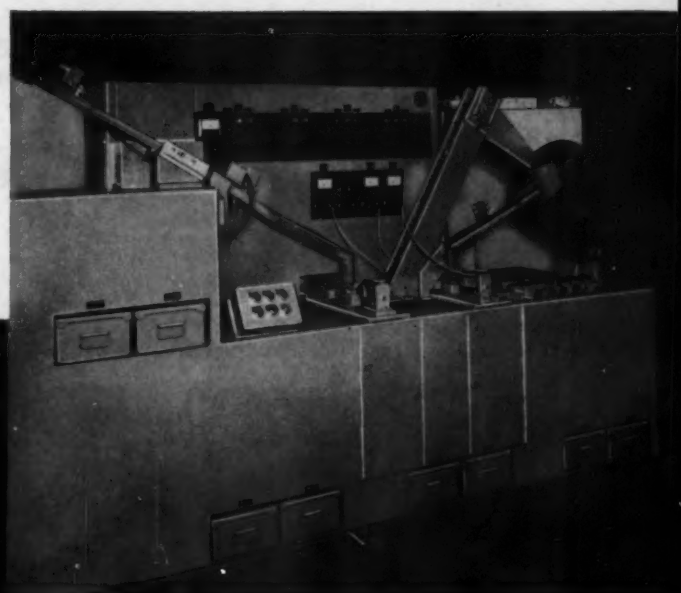
RCA AUTOMATIC INSPECTION SYSTEMS ASSURE 100% RELIABILITY

To maintain that higher degree of accuracy essential to today's extended guarantees, more and more manufacturers are turning to RCA 100% inspection. Experience has shown that even with the best statistical quality control, defective parts can and do slip through. But with RCA high speed systems, 100% reliability is assured—often with the added bonus of increased inspection rates, better yield, and lower costs.

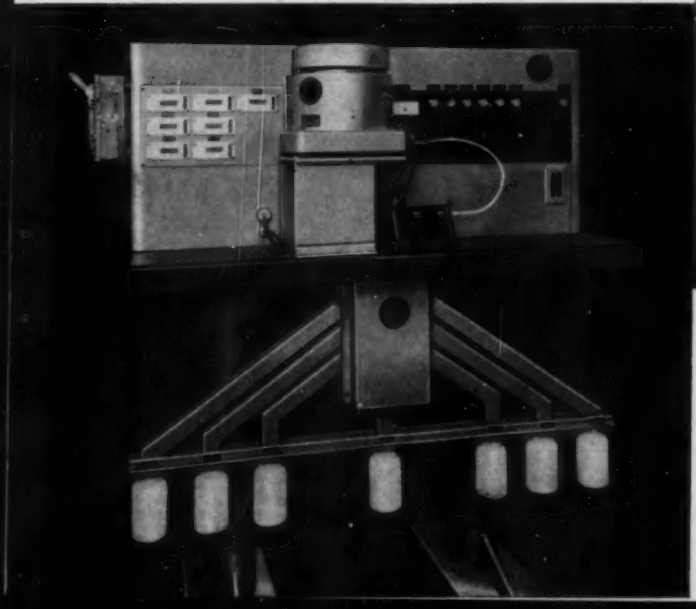
Whether for inspection of small parts, such as bearings and valves, or for large parts, such as axle forgings or brake drums, RCA has the automatic system for your equipment. Whatever your needs . . . a fully integrated automatic system, or simple mechanization of a single operation, RCA offers the most versatile range of equipment available.

See your RCA representative for the complete story. Or write to RCA Industrial Controls, 12607 Arnold Avenue, Detroit, Michigan.

TYPICAL EXAMPLES OF RCA ELECTRONIC INSPECTION SYSTEMS:



GAGING OF NUCLEAR FUEL PELLETS. Automatically checks O.D. of sintered pellets at rate of 4,800 per hour, and segregates into five acceptable categories in increments of .001" as well as over and under size.



AUTOMATIC TRUNNION CUP INSPECTION. Feeds and orients parts. Inspects trunnion cup crown, I.D., O.D., bottom thickness and I.D. at bottom of crown. Classifies parts as acceptable, salvageable and reject, at speeds of up to 5000 per hour. Can handle any sizes with minor adjustments.

RCA®

The Most Trusted Name in Electronics

RADIO CORPORATION OF AMERICA

CIRCLE 240 READER SERVICE CARD

VK PRECISION PARTS AND LAPPING

The SPACE AGE has made necessary products fabricated from old and new materials with unbelievably close tolerances. Actually, such fine tolerances had until recently, been associated exclusively with the manufacturing of gages.

As the demand for closer tolerances and finer finishes evolved, it was natural for manufacturers to call upon VAN KEUREN to produce their "QUALITY IN MILLIONTHS" in a variety of precision component parts.

We have capacity for the production of parts with such close tolerance requirements on both EXTERNAL and INTERNAL work:

TOLERANCES ranging from .000005" to .0002"
SURFACE FINISHES from.5 to 5 R.M.S.
FLATNESS from ¼ to 5 bands

We will quote to your specifications and again emphasize that we work with many materials including the following:

TOOL STEELS	CARBIDES	BRASS
STAINLESS STEELS	ALUMINUM	BRONZES
CHROMIUM PLATE		CERAMICS

For a *PILOT LOT* or a *PRODUCTION RUN* you can count on *QUALITY, PRICE and DELIVERY* when you call on VAN KEUREN

THE VAN KEUREN CO.
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate

Plug Gages • Measuring Wires • Optical Flats and Light Wave Equipment • Gage Blocks
Precision Lapping Service and Parts

can give us on where or how to obtain this will be very much appreciated.

C E Nyberg
Attleboro, Mass

We published all the information Mr Gabór submitted for this "Practical Ideas" item, so the only thing we can offer at this point is his mail address: András Gabór, II. Naproforgó-u.12, Budapest, Hungary—Ed.

Deathless Data

Dear Sirs:

I understand that AMERICAN MACHINIST published a paper in either 1903 or 1904, giving the experimental results obtained by two German experimenters named Bach and Roser on worm gear units.

I should be grateful if you would supply me with the complete reference to this article and at the same time should welcome any indication as to possible sources of the information in the United Kingdom.

As considerable urgency attaches to this problem from our point of view, an early reply would be appreciated.

L Taylor
Huddersfield
England

Just in case any other readers are curious about this paper, it appeared in two sections, in the July 16 and July 23 issues of 1903. The title: "Investigations of a Three Thread Worm Gear"—Ed.

"Better hurry Al, there's an engineering change coming!"

CALENDAR

Society of Automotive Engineers —National Aeronautic Meeting & Display, Apr 4-7, Hotel Commodore, New York, NY.

American Welding Society — Annual Meeting and Welding Show, Apr 17-21, Commodore Hotel and Coliseum, New York.

National Institute for Disaster Mobilization — Mutual Aid and Disaster Control Seminar, Apr 18-20, Shamrock Hilton Hotel, Houston, Texas.

American Society of Mechanical Engineers—Metals Engineering Conference, Apr 23-26, Penn Sheraton Hotel, Pittsburgh, Pa.

Metal Powder Industries Federation — Annual Meeting and Powder Metallurgy Show, Apr 24-26, Hotel Sheraton-Cleveland, Cleveland, Ohio.

American Institute of Mining, Metallurgical, & Petroleum Engineers—High-Temperature Materials Conference, Apr 26-27, Carter Hotel, Cleveland, Ohio.

National Screw Machine Products Association—Annual Meetting, Apr 29-May 3, Summerset Hotel, Boston, Mass.

American Foundrymen's Society —Castings Congress and Exposition, May 8-12, Brooks Hall and Civic Auditorium, San Francisco, Calif.

National Industrial Production Show of Canada — May 8-12 Canadian National Exhibition Park, Toronto, Ont.

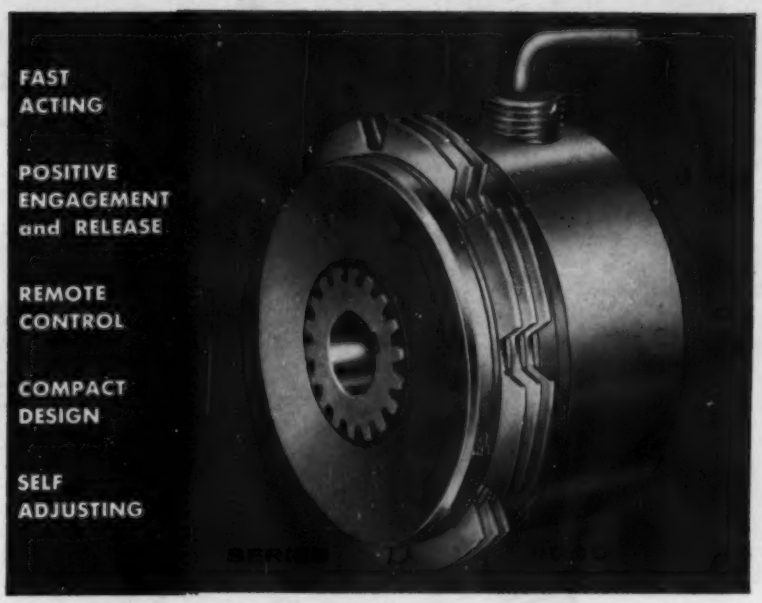
Material Handling Institute — Eastern States Show, May 9-11, Convention Hall, Philadelphia, Pa.

American Society of Mechanical Engineers — Production Engineering Conference, May 10-12, Royal York Hotel, Toronto, Ont.

American Institute of Industrial Engineers — National Conference and Convention, May 11-13, The Sheraton Cadillac, Detroit, Mich.

Machinery Dealers National Association — Annual Convention, May 15-18, Shoreham Hotel, Washington, DC.

IDEAL FOR AUTOMATED MACHINES



Maxitorq

ELECTRIC

CLUTCHES and BRAKES

Incorporating advanced design principles proved through years of service, the MAXITORQ Electric Clutch is well adapted to all types of machine drives. Simple in design . . . built to machine tool standards . . . requires no adjustments, can be used either as a clutch or brake. Disc separators not only separate discs, but also break up residual magnetism and result in extremely fast, positive action with no drag or heating in neutral. There are few moving parts. Electrical operating unit remains stationary — hence, no troublesome slip rings, brushes, or difficult wiring problems. Operation is on standard 100 V D.C. Other voltages on special order.

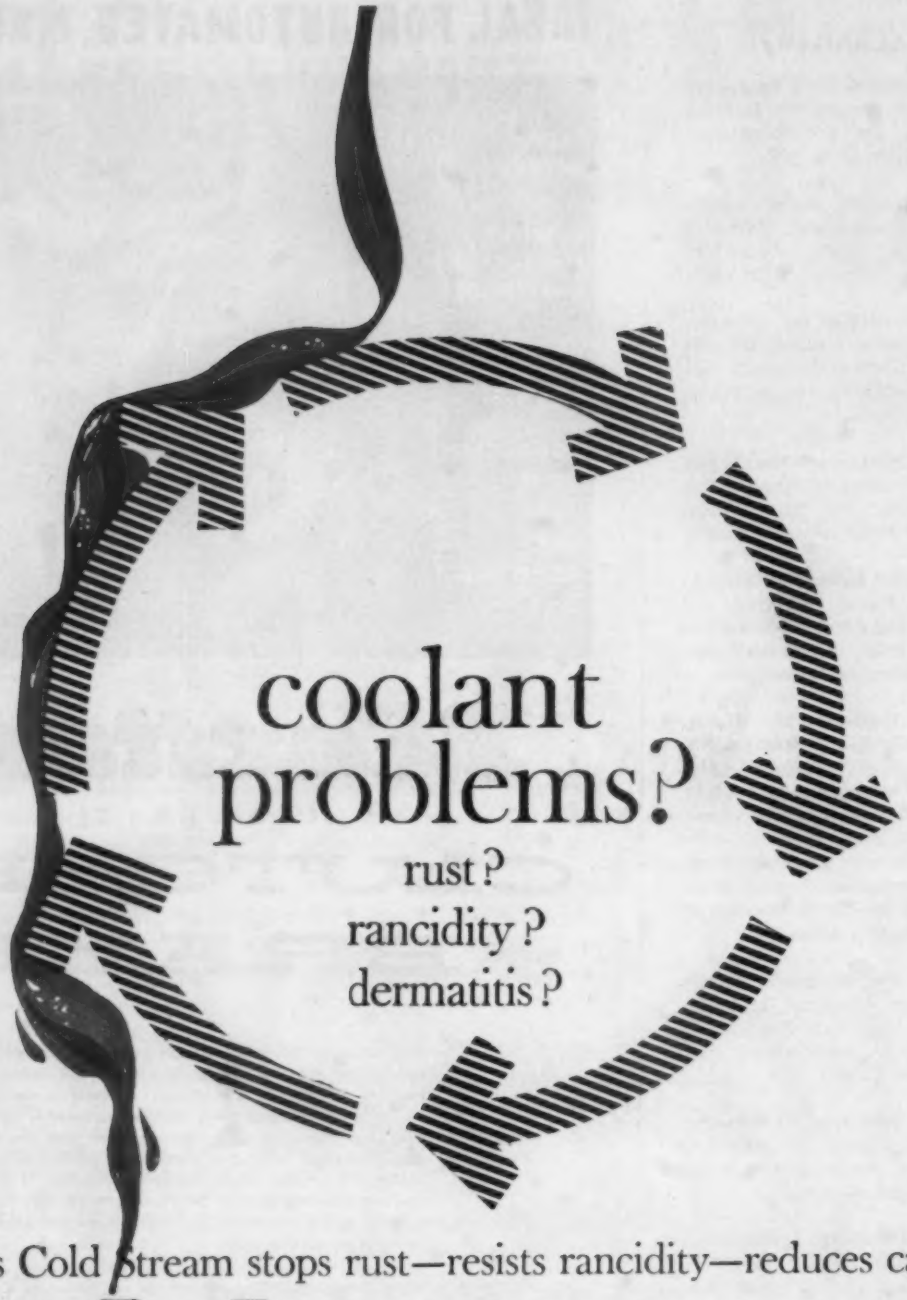
If you have a clutch or brake application where you are looking for NEW and IMPROVED performance, we invite you to bring the problem to us. Phone, wire, or write Dept. AM for Bulletin No. 90.

SPECIAL FEATURES

- Engaged entirely by magnetic flux.
- Operate either on-off or by varying voltage for torque control.
- NO troublesome slip rings or brushes.
- NO levers, cams, or other highly stressed mechanical parts.
- Operation is not dependent upon rotation.
- Finished complete, assembled, and ready to install on shaft.

ECJ61

THE CARLYLE JOHNSON MACHINE CO.
MANCHESTER, CONN.



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Dial the **Monarch** Series 62 Lathe for **faster metal removal,** greater **accuracy** of output in **less time**

...and thereby substantially reduce unit turning costs!

The Monarch Series 62 Dyna-Shift gives a greater ratio of metal removing hours to work hours than *any* less modernly designed machine. Such performance is the only true measure of lathe value.

It's a commonly accepted fact that the most efficient cutting condition results from the maintenance of correct surface speed. That's easier said than done. Who makes the calculations? Will they be accurate? Will the speed be changed for each diameter changed? And how about the time required to do all this?

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Every feature of the Series 62 matches the Dyna-Shift headstock for all-around superior performance. It has weight, reserve power, built-in precision, simplified maintenance. The famous Monarch "Air-Gage Tracer" may be applied. A vast array of accessory equipment is available.

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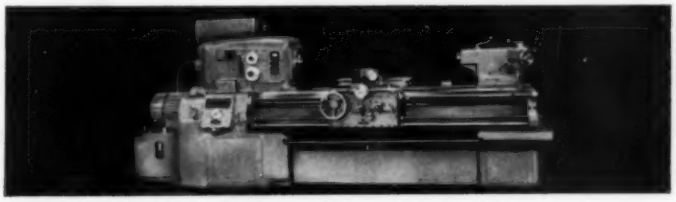

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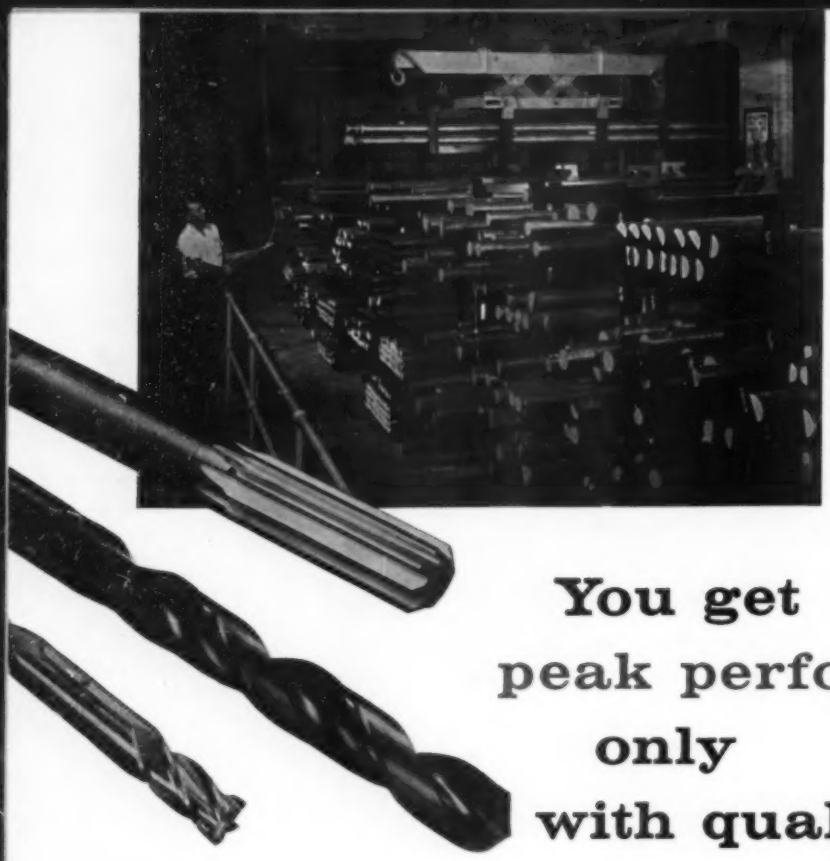

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Thus we make doubly sure that every shipment meets our exacting requirements before it is accepted and placed in stock, as shown in the photograph. This establishes a firm foundation for the subsequent heat treating, milling, grinding and other operations through which the steel must pass before the ◈ trademark is placed on the finished tools.

Telephone your Industrial Supply Distributor. He can give you prompt delivery of CLEVELAND Quality Tools from stock, and can make arrangements for one of our trained Service Representatives to help you solve your cutting tool problems.

THE CLEVELAND TWIST DRILL CO.
Cleveland 1, Ohio

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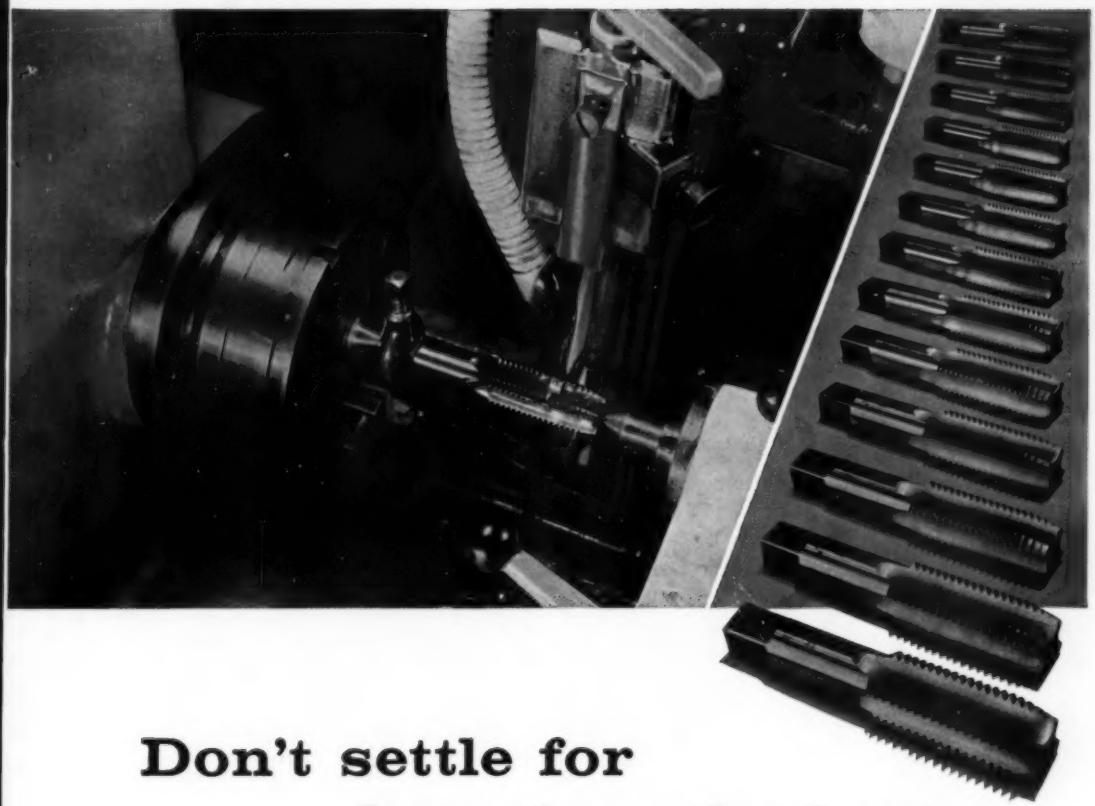

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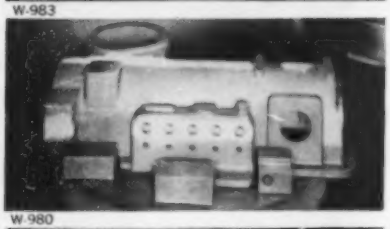
W-983



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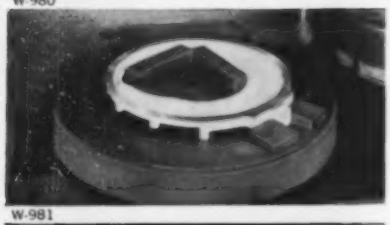

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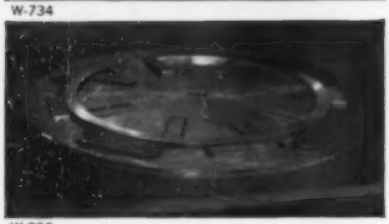

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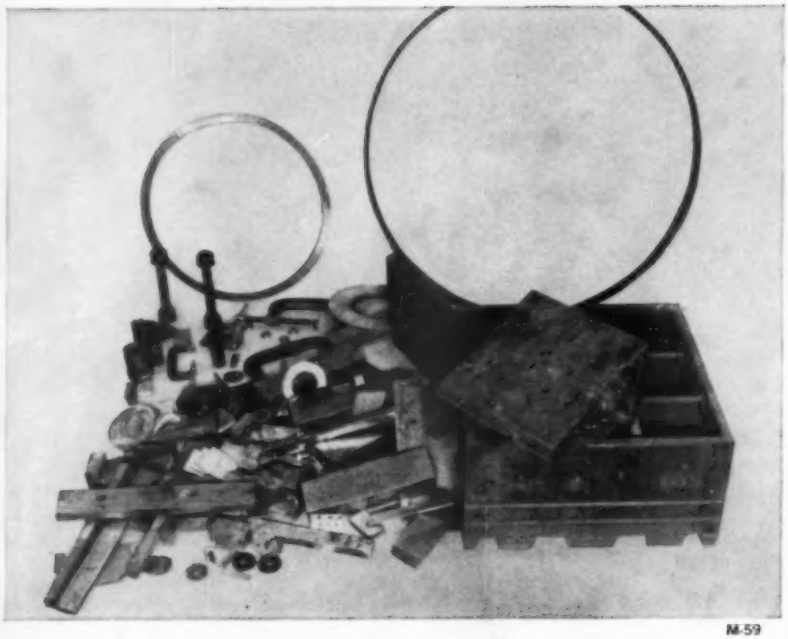
BLANCHARD GRINDERS



M-59

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Normally, the Blanchard magnetic chuck will hold ferrous work pieces during the grinding cycle.

But when fixtures *are* needed — for holding irregular-shaped objects, whether ferrous or non-ferrous — you can usually select your "fixtures" from the nearest scrap pile.

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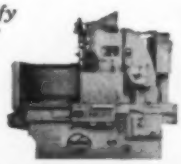

No. 18

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 State Street, Cambridge 39, Massachusetts

SPOT NEWS...

- **On-the-spot leasing and financing of used machine tools** will be available at the auction held March 22 at Colonial Manufacturing Co, Inc, Springfield, Mass. This is reported to be the first time such arrangements will be available. A representative of National Equipment Rental, Ltd, P O Box 847, Norwalk, Conn, will be on the premises on sale date to arrange leasing terms.

- **Electrical-resistance alloys with higher resistivity than Nichrome,** but which contain little or no nickel or cobalt, are being developed by India's National Metallurgical Laboratory. These Fe-Cr-Al combinations contain varying amounts of manganese, silicon, titanium, and zirconium. The alloys can be hot-rolled, but there have been some difficulties in wire-drawing.

- **Seagrave Corporation has abandoned its plans to produce a small car.** The Columbus, Ohio, firm is a prominent builder of fire engines.

- **$10,000 in awards is being offered for new hot-dip galvanizing ideas** by the American Hot Dip Galvanizers Association in cooperation with the American Zinc Institute. The $1000 awards will be accompanied by a medal and certificate of achievement. Entries should include a release of the application or idea for general use without payment or royalty. Send entries to the AHDGA, 5225 Manning Pl, NW, Washington 16, DC, before May 1, 1962.

- **Ford and General Motors have their eyes on Latin America.** Ford is seeking prices on machine tools for an entire production line (presumably for the Falcon) in Brazil. Output would be pegged at a low level at first. And both Ford and General Motors are looking into making automobiles in Mexico.

- **Rolf Berger, head of the Communist Metal Workers Union in East Germany** has told his workers that they must either produce better quality goods or suffer wage cuts. He claims that production losses due to waste and poor quality in heavy engineering, electrical and general engineering during the first half of 1960 amounted to $24 million.

- **New method of casting small titanium parts in production quantities** has been announced by Titanium Metals Corp of America. Process, called Impel Casting, has produced as many as 40 castings per mold and may go as high as 100. Earlier techniques used graphite molds and production was often limited to one part per mold. New molds are made of mild steel.

- **Work coils are one of the greatest problems in applying magnetic forming.** Convair (San Diego) makes inexpensive coils (3¢ each) that are destroyed in forming the part; also makes permanent coils prestressed with heavy end plates. Basic data on magnetic forming are presented on pp117-121. Details on applications at Convair will appear in the next issue.

- **Rumors that Vascoloy-Ramet has purchased the Wesson Company** are still buzzing in the cutting tool industry. Negotiations between the two cutting tool manufacturers have been going on for some time, but officials say that nothing has been put into writing yet.

- **Air Force has published a new glossary of missile and space terminology.** 75-page booklet lists some 1300 terms and definitions. It's the most comprehensive list to date. Titled the Interim Aerospace Terminology Reference, publication is available from the Office of Technical Services, US Department of Commerce, Washington 25, DC. Order PB 161913. Price $2.

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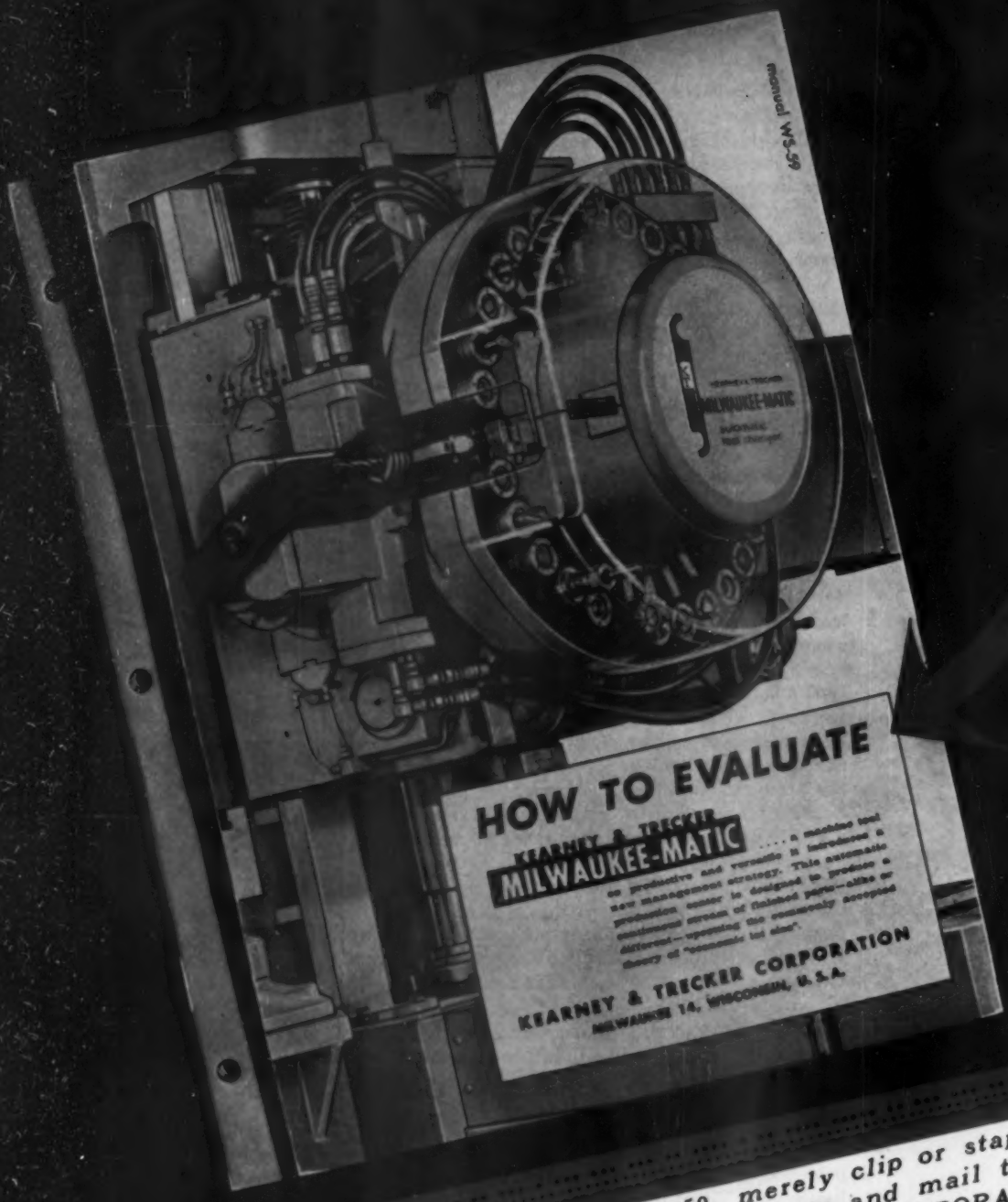

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CIRCLE 248 READER SERVICE CARD

WASHINGTON...

Machine tool bank . . .

A "bank" of used machine tools has been proposed by Congressman Frank Kowalski (D, Conn) as a way of supplying industrially underdeveloped countries with productive equipment and, at the same time, helping the U S modernize its own plant.

Kowalski is pushing his program now with the administration officials, but he realizes that there are many hurdles to be negotiated before his plans can be put into effect.

The plan is to stock the bank with surplus tools from the Defense Department and with tools from U S manufacturers, who would be given some kind of tax incentive for their contributions. However, at the outset, Kowalski feels that there's more likelihood of getting tools from government than from private sources.

Kennedy's defense changes . . .

The Kennedy overhaul of Eisenhower's FY 1962 defense budget is expected to go to Congress this week. The outlook is for the addition of $1.5 billion to $2 billion to Eisenhower's $42-billion military appropriation request—the bulk of it for weapon development and procurement, and for some major reshuffling of individual programs. The result will be important changes in the defense product mix.

Push for conventional arms . . .

The budget revision will reflect a fundamental shift in U S deterrent strategy to place greater emphasis on preparedness for limited war, that is, warfare which does not initially involve atomic arms or a direct attack on the U S.

This will bring increased procurement of so-called conventional weapons and equipment. Administration officials expect an increase of some 12% above current levels of Army and Marine procurement. Eisenhower's 1962 budget earmarks $1.8 billion for Army procurement, $210 million more than in FY 1961, and $159 million for the Marines, an increase of $22 million.

The Army wants to begin volume production of several new weapons now being manufactured only in prototype quantities and to expand output of other equipment already in production.

Examples of the prototypes: 105-mm self-propelled howitzer (GM's Cadillac Division is the R&D contractor); 175-mm gun (Pacific Car & Foundry Co); 81-mm mobile support mortar (Food Machinery & Chemical Corp); and 90-mm recoilless rifle (arsenal development).

Boost in production schedules . . .

Another production contract for the M-88 tank-recovery vehicle seems likely. Bowen-McLaughlin of York, Pa, already makes the item, but the odds are that a second production source would be picked.

Also up for an increase is the M-14 rifle, a new weapon which replaces three obsolescent types of small arms. Harrington and Richardson, Worcester, Mass, and Olin Mathieson's Winchester Division, New Haven, Conn, are now production contractors, but additional suppliers may be selected.

Additional equipment the army wants to buy: 7.62-mm ammunition (Remington Arms and Federal Cartridge Corp are now the two main suppliers); M-113 armored personnel carrier (Food Machinery & Chemical Corp makes this); the M-60 tank (Chrysler Corp); the Davy Crockett bazooka-type launcher for low-yield nuclear warheads (several firms supply prototype components).

Plans are also shaping up to expand procurement of a wide variety of tactical missiles (such as Lacrosse, Sergeant, and Redeye), small aircraft (examples: Grumman's AO-1 Mohawk, DeHavilland's AC-1 Caribou, Sikorsky's H-37 helicopter, and Vertol's HC-1 Chinook helicopter); mobile digital computers, forward area communications systems, and other electronic gear; trucks and other logistic-support vehicles.

Nike Zeus situation . . .

The Army wants at least $200 million extra to start producing equipment for two Nike Zeus anti-missile defense centers. The Eisenhower budget allots $250 million just to continue research and development. The Army's idea is to use the production capacity built up to manufacture test quantities of Zeus components. This is a watered-down version of the Army's original multi-billion dollar proposal to tool up for a full-blown production program to equip 70 Zeus missile batteries.

But Dr Herbert F York, Director of Defense Research and Engineering, recommends against Zeus production. He believes the system, as now designed, would be virtually helpless against an ICBM salvo attack including decoys, and that more R&D effort is needed before justifying a costly move to production. The Army is lobbying furiously, especially in Congress, for rejection of York's view.

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CIRCLE 249 READER SERVICE CARD

DETROIT...

Sales picking up . . .

"Like old times," the office postman remarked cheerily as he hefted a sack full of good news from automakers. Nearly every nameplate was reporting a late February sales surge.

Studebaker, which needs it the most, led the parade with a 49% gain in the pace of dealer orders. Marketing VP L E Minkel says it may "herald the long-awaited breakthrough in the nation's sluggish automobile market."

As the month drew to a close the daily selling rate touched 18,000, a respectable figure some 24% ahead of the mid-month pace. Both Corvair and Lincoln Continental were enjoying substantially increased business compared to last year at this time, and Dodge is starting to come back.

It is still not enough, however, to make a noticeable dent in high dealer inventories, so many factories are shutting periodically for adjustment. The second week of March saw eleven Ford and nine GM assembly sites temporarily inactive. On the bright side, Chrysler and Studebaker went back to work during this period.

Chrysler turbine . . .

For about $35,000 a researcher with a bonafide purpose can buy Chrysler's newest gas turbine. Deliveries will begin next April, and each engine is hand-made at the rate of one a month.

The newest unit weighs half as much as conventional reciprocating engine of 140 horsepower. Its developers claim equal acceleration and the unusual feature of engine braking, achieved through a variable nozzle system somewhat akin to the reversed thrust used to brake jet aircraft.

Executive engineer George J Huebner, Jr says that the variable nozzle system has licked three problems: 1) the expensive low-speed, part-load fuel consumption of gas turbines; 2) lack of engine braking characteristics; and 3) the time lag between pressure on the accelerator and full-power response of the engine.

Huebner's group at Chrysler made the vital breakthrough in 1954 that led to a light-weight, rotating regenerator. Without this, a turbine-powered car would either have to ignore fuel consumption or carrying a trailer-load of heat-exchange tubing.

The latest innovation involves positionable vanes (23 in all) to direct the 1700-F fuel-air mixture at the turbine-wheel blades with maximum effectiveness at all speeds. The new engine can be inclosed in a space that is as small as 27x27x25 inches.

Chrysler is currently testing prototype units in a custom-styled sports car, a Plymouth passenger car and a new 2½-ton Dodge truck. Performance, according to Chrysler claims, is comparable to a 200-horsepower piston engine.

Meanwhile in Dearborn, Ford Motor Co received a $3.8-million Navy contract to design a 600-horsepower, light-weight gas turbine with multi-fuel capabi ty for installation in amphibious vehicles, tanks and trucks.

Tough on junkyards . . .

It seems like Chrysler week in this column, but that is the way the cookie sometimes crumbles. All makers have undoubtedly made substantial progress in improving the strength and durability of cars in the past five years, but it remained for Plymouth General Manager Harry E Chesebrough to put the progress in perspective.

According to Chesebrough, a comparison between the 1956 and 1961 Plymouth shows that the latter has a body structure three times as rigid; is five to seven times more resistant to corrosion in critical areas (like the rocker panels) where rust is most likely to occur; and that its paint retains its original gloss twice as long and is three times better at resisting impact.

The idea for the analysis came when Plymouth found that its historic 12,500-mile proving ground endurance test, a gruelling run that is the equivalent of 100,000 civilian miles, failed to induce evidence of stress in the 1960 and 1961 models. The test has since been upped to 50,000 miles.

No normal usage equivalent has been worked out for the latter figure but Janeway Engineering Company (Detroit) was hired by a major taxicab operator to evaluate the new Plymouth. The consultants' presumably unbiased conclusion: Plymouth should economically last five years in taxicab service, which in this fleet means 250,000 miles.

The new standards of durability have also had their effect on Chrysler's Central Engineering Laboratory. Over 40 new major test techniques have been added so that intentional destruction could keep pace with car designers.

Fiendish devices range from a little machine that opens and closes a convertible-top zipper thousands of times a day (the cloak and suit industry should take note of this) to a massive pendulum that, when wound up and let go, inflicts a 6000-lb blow on the rear bumper. This is roughly the equivalent of your wife backing into the side of the supermarket at 10 mph.

—Don MacDonald

Courtesy Bannock Steel Company

Maintenance negligible

ON 6 YEAR OLD CINCINNATI® SHEAR

"We have had this Cincinnati Shear in almost constant operation for something over six years," says S. L. Cate of Bannock Steel Company, Pocatello, Idaho, "and, to date, maintenance costs have been almost negligible. We certainly feel this is truly a remarkable performance."

Bannock Steel Company recently installed a new Cincinnati Hydraulic Press Brake—clear evidence of their confidence in the Cincinnati line. See our insert in Sweet's Machine Tool file.

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CIRCLE 250 READER SERVICE CARD

AIRCRAFT and MISSILES... TRENDS

Major projects under scrutiny . . .

Battling bitter opposition in certain Defense Department circles, the Air Force is pushing to beef-up its fiscal '62 budget to include purchase of $20 million of new machine tools. Only $8 million of the $22 million alloted for numerically controlled machine tools for fiscal '61 remains in the Air Force coffers while many of the major West Coat manufacturers are still in need of government-financed tools to meet their contracts. One Los Angeles company alone is in the market for $6 million of such machines. For more details see p 107.

One major consideration of the defense budget is the off-again, on-again B-70 bomber development project. Cutbacks in the project are seriously under consideration by the Kennedy administration with the idea of going back to the Eisenhower policy of limiting development of the bomber to a stripped-down, prototype of the mach 3 aircraft by cancelling work on electrical combat systems.

However, until the fate of the shaky B-70 program is finally resolved, work on the project appears on schedule. Tooling of the B-70 fusilage has moved out of the planning stage into the production phase at Lockheed-Georgia (Marietta). About 30 types of ceramic brazing fixtures for the super-bomber are being readied. **Small business in the southeast** is feeling the impact of the B-70 program with contracts having been released to the Wheland Machine Co, Chattanooga, for specialized machine work and to the Glasrock Corp of Atlanta to supply ceramic blocks and cement for brazing.

The White House is also feeling the pressures between the Defense Dept, and the AEC and the Air Force in trying to reach a firm decision on the program to develop an aircraft nuclear propulsion system. The Director of Defense Research & Engineering wants to kill one of the two rival projects for such a system—apparently the General Electric contract (United Aircraft's Pratt & Whitney Div is the rival contractor). He reached his decision under Eisenhower and he's urging Kennedy to go along. But, the AEC and the Air Force expect greater results if both programs are continued, and they are pushing to have the White House endorse the projects.

The missile situation . . .

The administration is also taking a long, hard look at the present ICBM schedules. Some Air Force planners want to add three missiles to each of the six Atlas squadrons now under construction. There's also some thought being given to the cancellation of the last two Titan II squadrons—a contract to build a housing base for the missiles at Griffiss AFB (Rome, N Y) has yet to be awarded.

The Air Force is pushing for more missile money. It wants funds to accelerate work on Douglas Aircraft's Skybolt air-launched ballistic missile; the Eisenhower budget failed to set aside new development money for the project. Also wanted by the AF is a second production line for the Minuteman ICBM.

The Navy, too, is fighting to protect its share of the missile program. It is opposing a proposal to shelve the Eisenhower decision to arm the nuclear submarine "Long Beach" with the Polaris missile.

Propulsion systems stressed . . .

S K Hoffman, president of Rocketdyne, told the House Committee on Science and Astronautics that development of a flyable nuclear rocket engine system would ultimately increase the U S's space launching capability by ten times that currently planned. Testifying on the status of the national booster vehicle program, he claimed that present day liquid propellent booster engines can be rerun from 50 to 100 times. This reusability makes U S success in achieving ambitious space goals "depend on liquid propellent and nuclear rocket engine systems," Hoffman told the committee.

He stressed that work should be accelerated on such liquid propellent engines as the 1.5-million-lb-thrust single F-1 and the 200,000-lb-thrust hydrogen-fueled J-2 engines now under development for the National Aeronautics and Space Administration. Both types are scheduled for completion early in 1963. He told the House Committee that the ability now exists to build a large enough propulsion system of any type—nuclear, solid, or liquid—to achieve space launchings in the current decade.

Air Force gets space go-ahead . . .

Role of the Air Force in future U S space projects has been bolstered by a Defense Dept directive issued over the violent objections of the Army and the Navy. Under its terms, the Air Force will dominate R & D of space vehicles and weapons, satellites and proposed "anti-satellites." Existing Army (Advent communications satellite) and Navy (Transit navigation satellite) programs will remain under those services, however.

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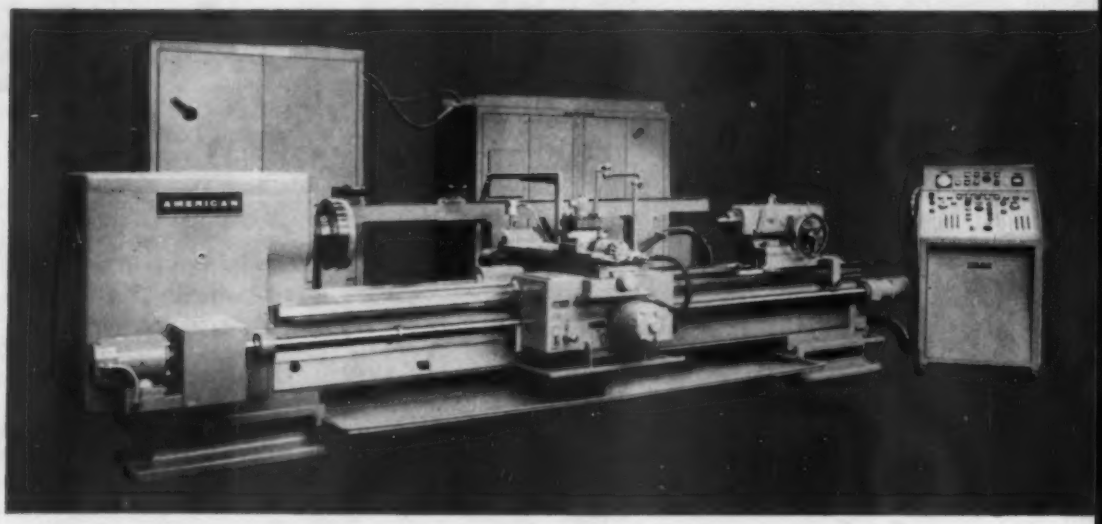

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MACHINE TOOLS...

Air Force contractors need tools . . .

Air Force contractors have definite requirements for a large number of numerically-controlled machine tools. They claim that if the Air Force will provide the funds with which to buy these machines, production savings up to 80% can be made.

Around $22 million will have to be allocated by Air Force top brass to meet these requirements for the fiscal year ending next June 30. Of that amount about $10 million already has been committed in actual orders.

If the additional $12 million is approved, about half of it will be for machines for a single southern California contractor.

On top of current requirements already mentioned, Air Force contractors will need new machines in fiscal 1962 (beginning next July 1) that will add up to even bigger orders than those planned the current fiscal year.

Some Detroit buying appears . . .

No huge automotive tooling programs, similar to those in 1955-1956, are on the Detroit horizon. But this does not mean that things are dead.

Chevrolet recently bought two big transfer-machine lines for its Cleveland transmission plant. Two machine tool builders split the business. Chevrolet intends to purchase a third line, which may well go to one of the two builders who already has part of the business to date.

Cadillac has an impressive buying program which is wrapped around replacement of old machines with new to achieve lower-cost production.

Willys is reported about to ask for bids for machines for a new production line for a six-cylinder, cast-iron engine.

Survey of its toolroom machines has been completed by one of the large automobile makers. A high ratio of machines was found to be 15 to 20 years old or older. But the company does not intend to spend money for replacements, though it would like to, because it cannot justify doing so in actual dollar savings!

Press builders have benefited from two whopping orders from Detroit in recent months. One was from Ford and the other is said to have been from General Motors. These are the orders that put the big bulge in metal-forming machine tool bookings in October and again in January.

Sizable orders for 1963 models . . .

Transfer-machine builders are confident that the automotive industry will have to place sizable orders for tooling 1963 models to be introduced in the fall of 1962. This business should come in during the fourth quarter of this year or earlier.

Though some rebuilding orders will be inevitable in connection with these programs, the fact is that in the case of General Motors most of the so-called surplus reserve equipment in the corporation has been worked off.

Big Soviet order pending . . .

Norton Co is reported in the final stages of negotiation for a machine tool order from Russia.

A top Norton official is understood to have been in Moscow recently in connection with this order, which is believed to be for automated machines for an automotive production line. Norton does not have an export license for shipment of the order.

Despite the fact that Bryant's shipment of 45 internal grinders to Russia has been permanently suspended (for detailed story, turn to p122), there has been no holdup of shipment of machines to Russia by Jones & Lamson. Commerce Department decided that J&L machines were not sufficiently "critical" to warrant revocation of the export license.

Ford to make car in Brazil . . .

Ford and General Motors have their eyes on Latin America. Ford is seeking prices on machine tools for an engine production line (presumably the Falcon) in Brazil. Output would be pegged at a low level at first.

If Ford proceeds, it will be the first time that one of the Big Three has decided to make a passenger car in Latin America. Both General Motors and Ford have truck-producing facilities in Brazil and now are deep into a program of starting truck manufacture in Argentina.

If Ford and General Motors get into passenger car production in Brazil, Argentina could be next. General Motors and Ford are looking into the profitability of making cars in Mexico. Like the Brazilian and Argentinian governments, the Mexican government is itching to have its own automobile industry and is said to be putting on pressure to force such a development.

South Africa is another spot where General Motors is taking a close look. But any action there is more remote than a Mexican program.

The big automotive boys are not averse to buying good used machines in setting up initial facilities in less-developed countries. One car maker did exactly that to the tune of $800,000 not long ago. Machines were of 1953-1954 vintage.

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MATERIALS...

Strongest fasteners . . .

For their weight, the strongest metal fasteners ever produced are being made of beryllium metal. Developed by Standard Pressed Steel Co, Jenkintown, Pa, the new bolts, one-fourth the weight of steel, will offer immediate weight saving possibilities in space and missile vehicles as well as other structural components.

Pound-for-pound, the new beryllium shear bolts are nearly twice as strong as the best comparable steel superbolts. Breakthrough came when SPS researchers isolated real source of beryllium's structural trouble to date: notch sensitivity. What most investigators thought to be an inherent general brittleness, SPS showed was a sensitivity to notches or surface discontinuities.

By eliminating "notches" such as microscopic surface scratches created in working the metal, and by beefing up other necessary notches, such as the head and threads, weaknesses thought to be inherent were eliminated.

Out of this finding, SPS determined two key design and processing techniques — involving surface finish and thread-root contour—that increase by as much as a hundredfold the capabilities of threaded beryllium parts.

Unprecedented transverse ductility was developed in the beryllium fasteners, a physical quality that alone triples their double-shear strength. Fatigue strength, formerly thought to be poor, is one of the most outstanding qualities of the new shear bolts. Their fatigue strength is equal to some of the better steel bolts and out of all proportion to beryllium's other physicals. The beryllium bolt's endurance limit is actually equal to its yield strength.

Chemical surface finishing, instead of grinding, eliminated both notching and stress buildup in the surface. A large thread-root radius—1.5 to 2.5 times that of conventional rounded roots—is tangent to the flanks of thread at a depth of only 55% of full form as compared to only 83-1/3% for the most widely used military and industrial standards and 75% for the SPS large radius Hi-R form.

Plastic turbines . . .

Turbodrills with turbines made of plastics have been successfully tested in oilfields at Bashkiria and Tataria, according to USSR reports. Conventional materials in Soviet turbodrills are cast steel, produced by a complicated and expensive casting process. In addition, they wear out in 150 to 200 hr with the result that 1.5 million turbine sections must be produced annually just for spare parts.

Replacement of the steel casting with a molded plastic part is 10 times cheaper, faster, and more precise, Soviets claim. If all turbodrill turbines were made of "Kapron", the Soviet plastic, annual savings would be 70 million rubles. Further tests showed polypropylene even better material than Kapron because latter swells somewhat in water. *Observers note that USSR still suffers from a shortage of plastics* and this frequently delays transition from laboratory results to industrial use.

Silicon infrared optics . . .

A commercially feasible, relatively low-cost process for producing silicon infrared optical components of various sizes and shapes has been accomplished by the Texas Instruments Co, Dallas, Texas. Under a contract with the Manufacturing and Materials Technology Div, Aeronautical Systems Center, USAF, the new process permits production of infrared optical components not previously available to meet aircraft and missile needs.

Strength of glass . . .

Silica glass is the strongest bulk substance known, according to experiments conducted recently by Dr Wm B Hillig of General Electric Co's Metallurgy and Ceramics Research Dept. Its strength in bulk, in fact, is surpassed only by *whiskers* of graphite, iron, and sapphire. Bending test on samples over 0.020 in. in diameter showed strengths of more than 1.1 million psi. Tensile strength up to 1.92 psi also was reported. The experiments that resulted in the high strength measurements were conducted at 78° Kelvin, liquid nitrogen temperature.

Theoretical estimates of the maximum strength of glass—the point at which the material separates because the atoms are pulled apart—have ranged up to 0.2 of the Young's modulus, which, for silica glass, is about 10 million psi. Hillig's experiments have not only demonstrated, with commercially available fused quartz, that 2 million psi can be reached but they also indicate that the maximum strength is probably much greater.

Under different conditions, such as at room temperature, strength fell off rapidly. Liquid nitrogen temperatures presumably helped prevent corrosion at surface flaws, which weakens the srtucture. Mechanical damage of even the slightest extent also drastically reduced the strength. Even touching the specimen with a fingertip reduced the strength to 50,000 psi.

HERE ARE PROGRESSIVE STEPS IN THE EXTRUSION OF AN AUTOMOTIVE BEARING RACE

1. Metal starts as ¾" diameter cut-off from coil stock.
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3. Extruded to configuration.
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WHAT'S AHEAD... in Metalworking

TRENDS

No major change in production levels . . .

Metalworking production continues to show only sideways movement. Many companies throughout the industry seem to feel that the worst is over and that increased activity is not far off. But the climb back to normal output may take quite a while.

Steel production has chalked up a series of small gains, none of which appear truly significant. Most steel manufacturers are expecting a good second half, with output of anywhere from 5% to 25% above what it is now.

Tool and die shop business is slow. There are no rumors of major programs coming out of Detroit yet, but the feeling is that anything could start a turn upward. Shops that have diversified, so as not to be too dependent on Detroit, report that their volume is fair. Others, not so diverse in their product mix, report low volume.

Metalworking job shops are doing fair business now, but expect a second-half boost of between 5 and 10%.

Aircraft parts producers report a spurt in their activity that is unparalleled in recent years. One major jet-engine-parts maker has had to recall production people for the first time in several months. Producers are happy, and admit that reinstatement of the B-70 program has meant a lot to them.

Gear manufacturers are none too optimistic about the remainder of the year. Several companies attribute poor sales to poor machine tool, auto, and home appliance sales. Except for those gear manufacturers who have government contracts, the business talk is quite gloomy.

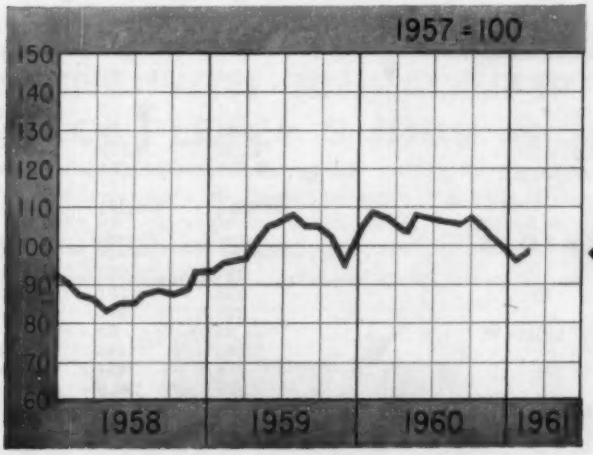
Bearing manufacture continues slow. For one major manufacturer, the fact that there have been no further layoffs is looked upon as a sign that business will soon start back up. In general, though, manufacturers expect the year to be a good one, despite the fact that it is slow in starting.

Industrial fastener shipments dropped to 75 in the latest month (1956-58=100) on the Industrial Fasteners Institute shipments index. Cutbacks in auto production would indicate that further declines may be taking place this month. Nevertheless, the outlook is for a better second quarter.

Metal stampers report the level of activity at this time, though on the average lower than last year, is fair, and most stampers are optimistic for the rest of the year. Hopes seem to be pegged on a general upturn in the economy late in the second quarter, with the feeling that as the economy moves up, the stampers will be carried up with it.

Radio and TV manufacturers say production levels are holding steady but sales, in general, are poor. Sales are off 20% to 30% from a similar period last year. Most major manufacturers decline to predict what the second half of the year might bring.

The plumbing equipment producers expect an upturn as soon as the weather breaks and construction gets going again. Right now, though, business is very poor. One company said, "The year as a whole may turn out to be pretty good, but we have an awful lot of ground to make up."



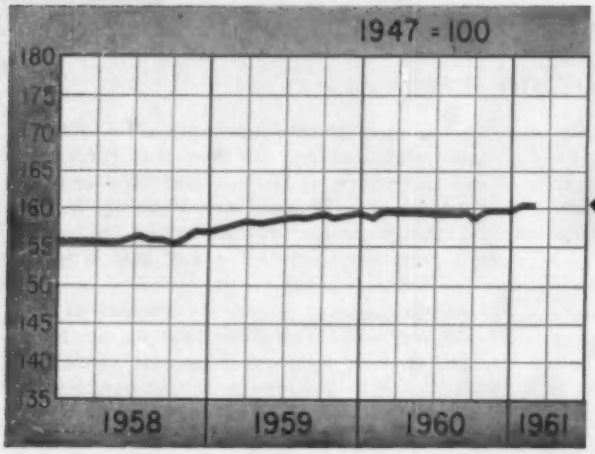
AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	FEB Estimated	JAN Preliminary	DEC Revised	JAN Year Ago
Total Index	**98**	**96**	**99**	**109**
Machinery		**94**	**95**	**106**
Electrical Machinery		**108**	**109**	**117**
Autos		**89**	**98**	**127**
Other Transportation		**88**	**90**	**88**
Other Metalworking		**101**	**105**	**111**

◀ CIRCLE 253 READER SERVICE CARD

TRENDS WHAT'S AHEAD... in Business



160.4

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	FEB Estimated	JAN Preliminary	DEC Revised	JAN Year Ago
Total Index	**160.4**	**160.3**	**159.9**	**159.6**
Metalworking Machinery	**195.2**	**195.0**		**189.8**
Other Machinery exc. Electrical	**174.7**	**173.4**		**172.4**
Electrical Machinery	**158.6**	**158.8**		**162.4**
Fabricated Metal Products	**148.0**	**148.0**		**148.0**

Beginnings of a thaw?

From numerous bits of recent business news you can begin to piece together a solid basis for optimism about the course of the economy in the months ahead. And although the actual upturn in business cannot yet be pinpointed, forecasters are convinced that business shortly will begin to improve, and that the second half of 1961 will be a period of rising economic activity.

The latest Commerce Department report on business capital spending plans is one reason for this gathering optimism. Like the McGraw-Hill survey late last year, the more recent Commerce Department sampling indicates that spending for new plants and equipment will dip by only 3% in 1961. This is a mild drop by recent standards. And it leaves capital outlays at a level high enough to ensure that the current business decline will be a mild one.

More important, the government survey suggests that capital spending will again be on the upswing in the latter half of the year. If so, stepped up capital expenditures will come at a time when businessmen are likely to begin adding once more to their inventories. Business investment, therefore, appears slated to be an expanding force in the economy in the latter half of the year. And expansion in this key segment of the economy enhances prospects of generally improving business.

Moreover, evidence suggests that government efforts to boost other key sectors of the economy, such as housing construction, also will begin to bear fruit later this year. So chances of a fairly vigorous economic rebound are good.

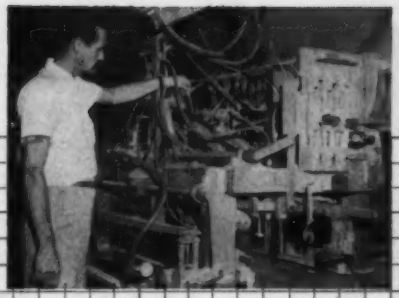
Ending the current mild business decline thus is not the nation's major economic problem. More crucial is the task of adopting policies that will encourage the economy to resume the rapid year-to-year growth of earlier postwar years. This task will require longer-term programs, such as tax reform, of government and stepped-up research and development of industry.

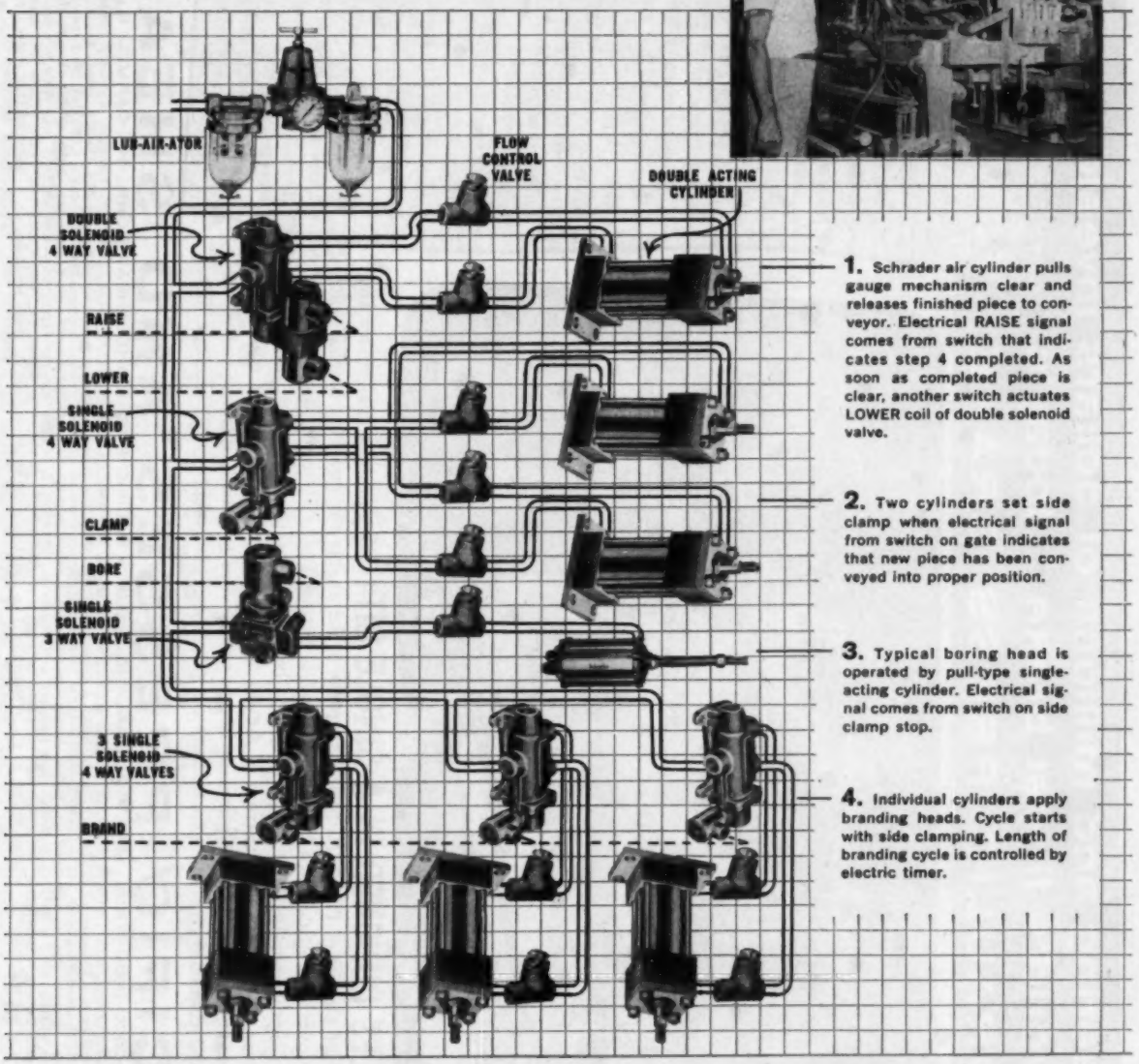
WEEKLY BUSINESS INDICATORS	*Latest Week*	*Preceding Week*	*Year Ago*
Business Week Index of Activity (1947-49=100)*	141.0	140.6	157.9
Steel ingot production (thousand tons)	1,580	1,582	2,645
Electric power output (million Kilowatt hours)	14,226	14,239	14,262
Production of automobiles	91,655	100,331	138,513
Engineering construction awards (*Eng. News-Record*, thousands)	365,324	405,561	284,484

MONTHLY BUSINESS INDICATORS	*Latest Month*	*Preceding Month*	*Year Ago*
Refrigerators sales (thousands of units)	253	253	283
Vacuum cleaners sales (thousands of units)	254	281	294
Washers sales (thousands of units)	223	274	264
Household electric ranges sales (thousands of units)	62	65	80
Radio production (thousands of units)	866	968	972
Television production (thousands of units)	368	434	593
Gear sales index (1947-49=100)	216.5	198.9	233.9
Foundry equipment new orders index (shipments, 1947-49=100)	101.2	106.5	95.9

*Seasonally adjusted

The Lane Furniture Company of Altavista, Virginia, broke its cedar chest production line into groups of operations for air-automation. One of the many circuits, shown here, was designed with quality Schrader components to brand the chest tops with a trademark, bore hinge recesses, and perform vertical and horizontal gang drilling operations. All three jobs are completed in less than 30 seconds!





1. Schrader air cylinder pulls gauge mechanism clear and releases finished piece to conveyor. Electrical RAISE signal comes from switch that indicates step 4 completed. As soon as completed piece is clear, another switch actuates LOWER coil of double solenoid valve.

2. Two cylinders set side clamp when electrical signal from switch on gate indicates that new piece has been conveyed into proper position.

3. Typical boring head is operated by pull-type single-acting cylinder. Electrical signal comes from switch on side clamp stop.

4. Individual cylinders apply branding heads. Cycle starts with side clamping. Length of branding cycle is controlled by electric timer.

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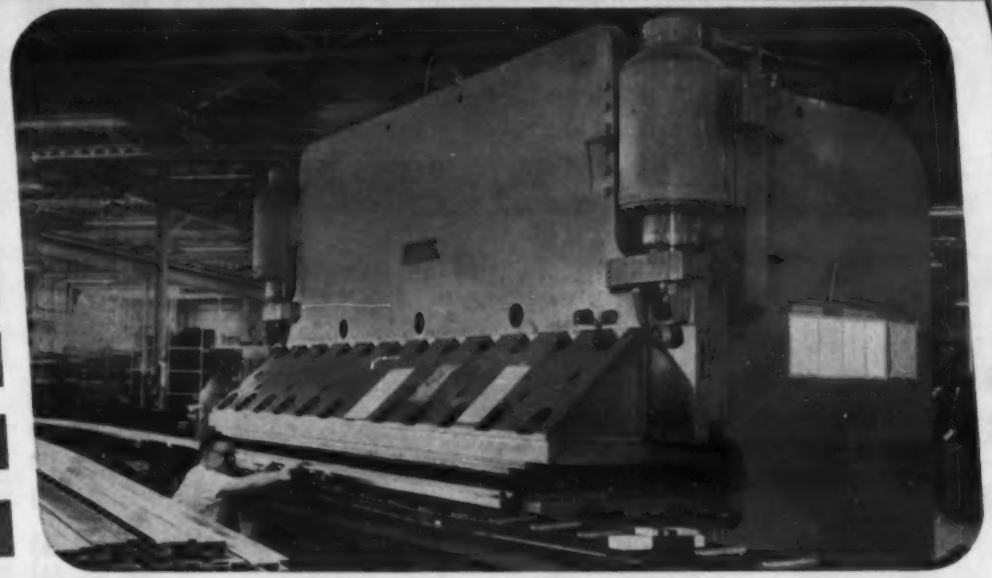

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- Tandem operation of press brakes for forming pieces 40 ft. or longer (1953)
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American Machinist / Metalworking Manufacturing ESTABLISHED 1877

Our Doddering Trade Policy

Washington does not have any clear-cut policy of trading with Russia. The Bryant Chucking Grinder Co case is ample evidence of that fact. The miserable handling of this case suggests that we had better get a policy and stick to it unless we wish to do our trade harm in world markets.

For years the United States . . . and its allies have maintained a Positive List of products which none of them will ship to Communist-bloc nations. In 1958 the type of internal grinding machines made by Bryant, along with certain other machines, was removed from the list.

Two years later, in early 1960, Bryant secured in advance from the Commerce Department a license for shipment of grinders for which it hoped to get an order in Moscow. Four months after that it got the order and started manufacture. Everything went smoothly until January.

Then the Senate Internal Security Subcommittee asked that the license be suspended pending an investigation. Final outcome of the subcommittee's action was permanent revocation of Bryant's shipping license.

The committee hearings . . . were conducted in secret session by Senator Dodd, vice chairman. The public has not been able to see the committee's final report. No one outside the committee has been given a chance to read the text of the testimony of expert witnesses. The whole proceedings have been cloaked in considerable mystery. Why all the secrecy?

The Defense Department, the Commerce Department, the Senate and the House (in the person of Representative Lipscomb) have all got into the act of deciding whether machine tools should or should not be shipped to Russia. And just where does the State Department come in? It has not been heard from. Yet it is supposed to decide our foreign policy.

Senator Keating has come forth with the suggestion that the Defense Department be given the power of veto over any license for shipment of goods to Russia. If that power should be conferred upon the Pentagon, all of us might as well forget about doing any business at all with Russia and turn the Russian market over to our western European allies who do not allow their emotions to control their actions.

A number of prominent American manufacturers have gone to Moscow or sent representatives in the belief that the orders they sought were within the approved limits of our trading policy with Soviet Russia.

Suddenly they discover . . . that they have been misled. The executive department in Washington charged with the task of administering trade is overruled. A contract between a Russian buying agency and a U S manufacturer no longer is to be honored, because our own government has ordered it so. The situation becomes chaotic.

The Bryant case—how it was handled and the final decision—discourages U S industry from trying to do business with the Communist bloc. And in turn it drives Communist trade into the waiting lap of our allies. In general, it is not likely to delay the Kremlin very long from carrying out whatever program it has set for itself.

So let's have at the White House level, where it will stick, a clean definition of what our trade policy with Russia and other Communist countries is to be. And then let's stand by it and not have it destroyed by politics or emotion.

Burnham Finney EDITOR

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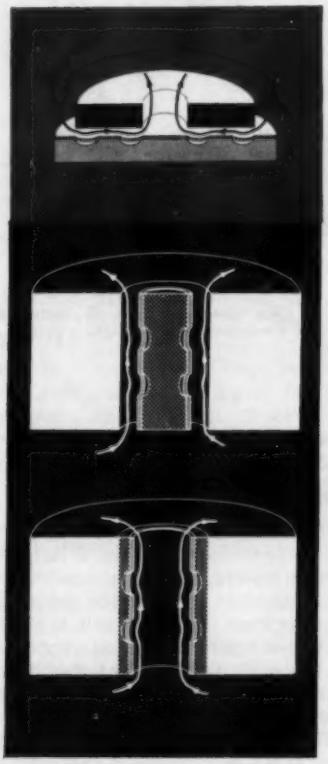
VOL 105, NO 6 **American Machinist** / *Metalworking Manufacturing* MAR 20, 1961



MAGNETIC FORMING!

WHAT IS IT?

Now you see it, now you see a different shape. The newest concept in high-energy forming is as spectacular as any magician's illusion.

This is magnetic forming, and it is no illusion but a direct conversion of electricity into force. Instantaneous, invisible, it may well become a powerful metalworking tool.

Magnetic forming is a really significant new development in metalworking. As such it may have an even greater potential than another recent and highly touted method of forming metal —explosive forming.

This article provides the basic principles of magnetic forming, describes three ways to apply them, and shows how to determine the cost and practicability of a given operation.

The first part of the article provides a simple explanation of the process and its application; the second gives the mathematical basis.

We offer no apology for the complexity of the second section —it is included for the benefit of readers who seriously wish to pursue this revolutionary new development. —THE EDITORS

By D H Birdsall, F C Ford, H P Furth, and R E Riley,
physicists
University of California
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Electric energy, in the form of a magnetic field, can be converted directly into useful work in forming metal parts.

Magnetic pulses lasting only six millionths of a second and exerting a pressure of 560,000 psi have caused plastic flow in hard bronzes and steels[1] under conditions where the work would fracture at conventional forming rates.

This result is obtained because magnetic forming is one of the high-energy processes, like explosive forming, and obtains the desirable properties that occur in very rapid forming.

To secure a magnetic pressure of 560,000 psi requires a 1 megagauss magnetic field (the gauss is a measure of the density of magnetic flux). The formed tubes illustrated on the next page were produced by a 200-kilogauss field.

When large objects are to be formed, explosives have the merit of avoiding investment in an expensive electrical energy source, but for objects of moderate size the magnetic forming method seems more convenient and reliable.

Flexible method

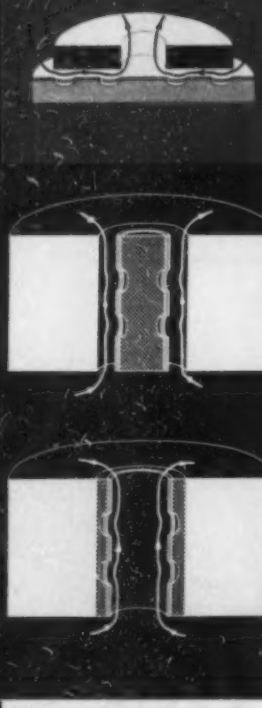
Compared with conventional mechanical or hydraulic stamping methods, magnetic forming has the advantage of flexibility. With a given magnet, objects of many sizes and shapes can be formed; indeed, the magnetic hammer can be made to serve as a hand tool.

Unlike ordinary hammers, the magnetic hand tool strikes a smooth blow over a large area instead of making a local impact. This operation is like that of a die and, in fact, in die forming the magnetic hammer serves as one of the pair of dies.

Already, magnetic pressure has been found especially well suited to the swaging of metal tubes. This is particularly true when thin tubes are to be swaged onto a soft or irregularly shaped object.

At General Atomics, magnetic forming was applied to swage copper tubes onto the ends of coaxial cables. This technique has been taken up at other laboratories[2] and similar operations are already being applied industrially at Convair.[3]

An operation that cannot be performed by any conventional means is the shaping of metal parts inside insulating parts or inside metal parts



MAGNETIC FORMING! . . .

THE PRODUCTS...

1. Aluminum dishes, ⅛-in. thick, formed by magnetic hammer at 150 kilogauss. The blanks were 4 in. dia and the depth of draw is 1 in.

2. Aluminum alloy tubes of 1¼ in. ID formed by compression onto a mandrel. A 200-kilogauss pulse was used for forming

of lower conductivity. The magnetic expansion technique could be used, for instance, to anchor a metal inner liner permanently inside a ceramic bushing. The magnetic force can strike right through an insulating covering or coating.

Certain metals can only be formed at very high temperatures. To form such metals by mechanical means can be about as difficult as to try to contain a hot (50,000 F) plasma in a physical vessel. The plasma physicist solves his problem by providing a "magnetic bottle," and this approach seems equally promising for forming.

How it began

Magnetic forces of moderate strength are familiar in electric motors, magnetic chucks, and similar devices. It has thus long been evident that magnetic forces are capable of producing powerful effects.

As early as 1907, E F Northrup reported the deformation of liquid metal pools during the passage of a current. In his Physical Review article[4] Northrup predicted that "further thought along an engineering line may bring about developments of a unique and useful character."

Magnetic field strengths that were sufficient to deform substantial solid conductors were first achieved by P Kapitza[5] during the 1920's. In the 100- to 1000-kilogauss experiments of Kapitza (and of more recent high-field experimenters[1, 6]) magnetic forming has been primarily a destructive nuisance.

High-field coils tend to become enlarged by magnetic pressure, and may even explode. Metallic inner liners of such coils are easily crushed. These phenomena, though undesirable, have served to stimulate interest in harnessing magnetic forces to form metal intentionally.

At the Lawrence Radiation Laboratory the technique of high-field metal forming dates back to 1955. S A Colgate[7] initiated experiments on the forging of solid sodium in a 100-kilogauss pulsed magnet. The object was to study the growth of surface ripples during the forging of the sodium.

In 1957, D H Birdsall and R E Riley formed copper tubes against a patterned mandrel with a 200-kilogauss pulsed magnet.[8] At about this time, thin aluminum tubes were used by F C Ford and R F Post to demonstrate magnetic compression in a mirror machine.[9] (A mirror machine traps hot ions between two magnetic coils which "reflect" the ions, thus acting as "mirrors.")

Two demonstrations

An exhibit of the latter kind was shown in Geneva in the summer of 1958, at the scientific exposition for the Second International Conference on the Peaceful Uses of Atomic Energy. At the industrial exposition held at the same time, a similar mirror-machine demonstration was held by the General Atomics Div of General Dynamics.

This led to the useful application of magnetic forming to swage cable connectors.[2, 3]

Compression forming of tubes

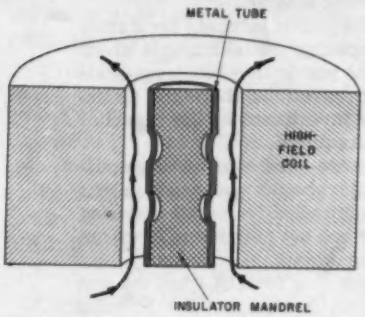
In applying magnetic forming in the manner shown in Fig. 3 to form a tube inward against a mandrel, a magnetic field is pulsed on during a time so short that the depth of penetration of the field is small compared to the wall thickness of the tube. Thus no magnetic field leaks to the inside of the tube.

If we assume that the wall thickness is 0.1 the radius of the tube, a 200-kilogauss magnetic field will produce a hoop stress (circumferential result of an applied radial stress) of 220,000 psi. The formed tubes shown in Fig. 2 were made under approximately these conditions out of an aluminum alloy with a tensile strength of 50,000 psi.

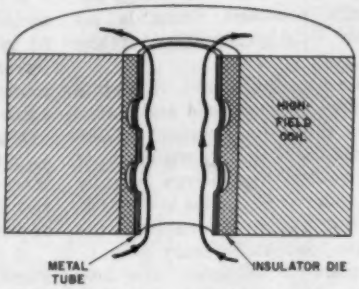
The tensile strength is relatively so weak that it has little effect on the rate of forming. The process is a dynamic one with the applied magnetic pressure balanced by the inertial pressure of the tube mandrel.

A dynamic regime like this is advantageous for metal forming because the deceleration pressures that develop at the time of tube impact against the mandrel can be made to exceed considerably the magnetic pressure that initially gives rise to the inward acceleration of the tube. This is the reason that exceedingly fine detail on the mandrel is reproduced on the work in Fig. 2.

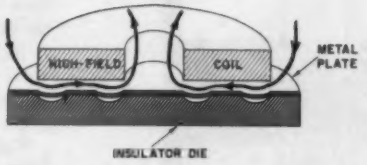
The magnetic field for a dynamic



3. Compression onto a mandrel. When the magnetic field is pulsed on and is excluded from the inside of the tube by "skin effect," the unbalanced magnetic pressure collapses the tube



4. Expansion into a ring die. A magnetic field is established inside the metal tube by a pulse slow enough to avoid the "skin effect." When field outside tube is removed the unbalanced forces expand the tube



5. Magnetic hammer for flat dies. Such a hammer could be made to serve as a hand tool, striking a smooth blow over a large area, making the hammer useful for repair as well as for production work with dies

forming operation need last no longer than the collapse time of the sample. If this mandrel is made of metal, this time must be less than the time required for the magnetic field to penetrate the tube wall. Otherwise, a magnetic "cushion" will develop between the tube and the mandrel, causing the tube to re-expand after the first impact.

With insulating mandrels

If the mandrel is made of insulating material, then sufficient magnetic flux must leak through the tube to fill the entire cross-sectional area of the mandrel before a significant back pressure develops. Accordingly, the collapse rate is then allowed to be considerably slower.

The aluminum tubes shown in Fig. 2 would be expected to develop a velocity in collapsing through a radial distance equal to the tube thickness of 30,000 cm/sec in a 200-kilogauss field. The theoretical time for displacement is about 60 microseconds.

The half-cycle time of the magnet[8] that was available to make these samples happened to be 500 microseconds. This is awkwardly long and caused the tube to collapse early and at lower velocity than calculated.

The critical times involved in this operation (the time required for collapse and the time required for field penetration to build a cushion) depend to different degrees on the dimensions of the tube. This establishes a minimum size that can be formed by a given magnetic field.

For copper, this is not very restrictive. For stainless steel, however, samples less than 1 cm in diameter become difficult to handle.

A possible remedy here is to apply an oscillating magnetic-field pulse instead of a unidirectional one. This will avoid the accumulation of a magnetic "cushion" inside the sample. The number of half-cycles that can be used is limited by the melting point of the work.

The detailed development of the points just discussed will be found in Equations 7 and 9 through 14.

It should also be noted that the velocities involved are high enough that there is often an advantage in evacuating the air from the space between the tube and the mandrel.

Expansion forming of tubes

Magnetic forming can be applied equally well to expansion of tubes as shown in Fig. 4. A slow-rising magnetic field is established inside the magnet coil and the tube that is to be expanded. If this rise time is much greater than the time required for field penetration, there will be little pressure on or heating of the tube material during this phase.

Next, the magnetic field is reduced to zero outside the tube during a time that is less than the time of field penetration. We then have the conditions for tube compression in reverse and the trapped magnetic field will press the tube outward.

Magnetic hammers

Magnetic forming can be applied to a variety of shapes other than the cylindrical forms discussed thus far. Much the same principles will apply.

A magnetic hammer for shaping flat parts is shown in Fig. 5, and some dish-shaped samples made with it are shown in Fig. 1. In addition to using this hammer to create a depression in a flat surface, it can be made to pull a bulge by a technique somewhat like that for the expansion of tubes.

The magnetic hammer and the tube-forming magnets operate to induce a circular eddy current in the samples to be formed, as in the secondary of a transformer, and this can be exploited to bulge the part. Another possibility is to apply a current directly to the work by means of two electrodes.

When a thick-walled or solid sample is to be formed, then we must have a magnetic pressure greater than the tensile strength of the material to be formed. In that case, the material begins to behave substantially like a fluid, and many of the phenomena of hydromagnetics can occur.

The most important implication of this statement is that hydro-magnetic instabilities may interfere with the metal-forming process unless special precautions are taken.

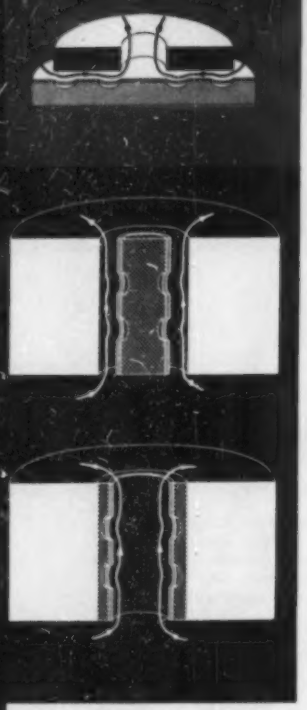
Thus the early sodium forging did not acquire a smooth surface but developed ridges running in the direction of the magnetic field. If such a sample is exposed to successive forging operations, even more pronounced distortions occur.

Fortunately the effects of these instabilities can usually be reduced by proper shaping of the magnetic field pulse in time and space.

Providing the magnetic field

The conventional way to produce a strong magnetic-field pulse is to discharge a capacitor bank into an air-core winding of some sort.[1]

This capacitor bank must be able to store the electric energy equivalent of the mechanical work that is done, plus the total magnetic field energy that is present at the time



of impact of the sample on its die, plus the joule heat that has been dissipated.

The heat will normally be negligible compared to the other energy requirements provided there is no significant field penetration of the work.

For the samples shown in Fig. 2, with a 200-kilogauss field and a surface area times displacement of 100 cc, the calculated energy requirement is 30,000 joules. The energy actually used to make the samples was 50,000 joules, but (as noted earlier) the pulse time was inefficiently long.

For optimum efficiency, the best way to operate is to make the rise-time of the magnetic pulse much shorter than the dynamic collapse time of the sample. In this way the initial magnetic energy is mostly converted to kinetic energy of the sample by the time there is impact with the die.

A disadvantage of this "most efficient" method of operation is that very high fields must be used, raising the mechanical requirements of the forming magnet.

A realistic cost estimate for a complete capacitor installation is about 30 to 50¢ per joule. For large-scale forming operations, therefore, an impressive investment in the capacitor bank is required.

Megajoule—and even 10 megajoule—capacitor banks do exist in the larger controlled-fusion laboratories, but they are not now found in manufacturing plants.

A redeeming feature, from the cost standpoint, is that for the forming of large workpieces, the applied pulse time can be made very long (see equation 13). When the pulse time is in the 10-millisecond range, the use of a motor generator or an inductance instead of a capacitor bank becomes practical. The cost of energy storage may then be 10% or less of the cost in capacitor banks.

The basic equations of magnetic forming

In conventional mechanical stress problems, the only body force that appears is that due to gravity or inertia. In magnetic forming problems, however, the magnetic force **F** appears which is given by:

$$\mathbf{F} = \mathbf{i} \times \mathbf{B} \qquad (1)$$

where **B** is the magnetic field and **i** is the current density:

$$\mathbf{i} = \frac{1}{4\pi} \nabla \times \mathbf{B} \qquad (2)$$

There are several systems of notation for electrical quantities. In this development, gaussian units are used consistently.

As a start, let us consider the relatively simple case of one-dimensional compression of a slab of metal lying in the yz plane and acted on by a B_z magnetic field (a B_z field will exert pressure along the x-axis). With this condition, equations 1 and 2 yield the partial differential equation:

$$F_x = -\frac{1}{8\pi} \frac{\partial (B_z^2)}{\partial x} = -\frac{\partial \sigma_x}{\partial x} \qquad (3)$$

where σ_x is the stress in the metal.

We can describe this situation by attributing to the magnetic field a scalar pressure $B^2/8\pi$ as though the magnetic field lines represented a sort of two-dimensional compressed gas. (Scalar is a mathematical term indicating magnitude without direction.) At 1 megagauss, this magnetic pressure amounts to 4×10^{10} dynes or 560,000 psi, as noted earlier.

From Maxwell's equations it follows that the energy density of a magnetic field **B** is also expressed by $B^2/8\pi$ (This identity of energy density and pressure is characteristic of a two-dimensional gas.) A magnetic field of 1 megagauss has an energy density of 4×10^{10} ergs or 1000 calories per cc.

The analogy between a magnetic field and a gas can be extended further when we calculate the magnetic-field distribution as a function of time. Here the basic equation is the "generalization of Ohm's law" which is developed in hydromagnetics[10]:

$$\frac{\partial \mathbf{B}}{\partial t} = -\frac{1}{4\pi} \nabla \times (\eta \nabla \times \mathbf{B}) + \nabla \times (\mathbf{v} \times \mathbf{B}) \qquad (4)$$

In equation 4, the first term on the right describes the diffusion of magnetic field through a conductor or resistivity η. The second term describes the change in magnetic field caused by the motion of the conductor with local velocity **v**.

When a magnetic field presses against a conductor, the situation is just like that when a gas presses against a porous wall: the gas distribution can change either by diffusion into the wall, or by physical motion of the wall.

From the previous example of simple slab geometry, we now have:

$$\frac{\partial B_z}{\partial t} = \frac{1}{4\pi} \frac{\partial}{\partial x} \eta \left(\frac{\partial}{\partial x} B_z \right) - \frac{\partial}{\partial x} (v_x B_z) \qquad (5)$$

Multiplying equation 5 by $B_z/4\pi$ and integrating over x leads to the equation:

$$\frac{\partial}{\partial t} \int dx \, \frac{B^2}{8\pi} = -\int dx \eta \, i_y^2 - \int dx \, v_x \frac{\partial}{\partial x} \left(\frac{B^2}{8\pi} \right) \qquad (6)$$

Equation 6 shows that the energy content of the magnetic field can be lowered in two ways: joule heating of the metal (first term on the right) and performance of mechanical work on the metal (second term).

In Reference 1 it is shown that the density of heat deposited in the process of magnetic field diffusion into a thick wall is equal to the density of the physical work that the magnetic field would have done if it had pushed back the wall instead of diffusing into

it. This work density is just the energy density of the magnetic field itself. The temperature rise at the surface of the wall, resulting from a half-cycle pulse of maximum strength B is given by:

$$\Delta T = \frac{B^2}{8C_v} \qquad (7)$$

where C_v is the specific heat per unit volume, which for metals is generally about 1. A megagauss pulse therefore causes a temperature rise of about 3000 C.

When v_x is not equal to 0 in equation 5, what remains is a diffusion equation like that for gaseous diffusion into a porous wall, or for the still more familiar process of thermal diffusion. From dimensional analysis of equation 5, it is clear that the distances of field penetration during a pulse of half-cycle time τ is measured by:

$$s \sim (\eta\tau)^{\frac{1}{2}}$$

If we identify s with the "skin depth"[11] of high-frequency electrical engineering, we have:

$$s = \frac{1}{\pi}\left(\frac{\eta\tau}{2}\right)^{\frac{1}{2}} \qquad (8)$$

Equation 8 gives $s \sim 10\tau^{1/2}$ for room-temperature copper.

The penetration of magnetic field during pulses of complicated shape, and in geometries other than the simple slab, can often be calculated analytically by the techniques developed for thermal diffusion problems.[12]

Some further discussion of the basic concepts of magnetic field pressure, energy density, and behavior in time, as applied to the technology of high-field magnet design, can be found in references 1 and 13. The literature on the "pinch effect" in plasma is also helpful in this connection.[14]

With the method of Fig. 3, magnetic field B is pulsed on during time τ short enough that skin depth s (see equation 8) is small compared with wall thickness. Let us assume that wall thickness δ is small compared with its radius R. Then the pressure-balance equation becomes:

$$\frac{B^2}{8\pi} = \frac{\delta}{R}\sigma_\theta + \delta\rho\frac{dv_r}{dt} \qquad (9)$$

where σ_θ is the hoop stress and ρ is the mass density of the metal.

According to equation 9 the velocity gained by the tube in moving through a radial distance equal to the tube thickness is:

$$v_a = \left(\frac{B^2}{4\pi\rho}\right)^{\frac{1}{2}} \qquad (10)$$

where B has been taken as a constant. This is the "Alfvén velocity" of plasma physics.[15] Time required to travel through displacement ϵ is then:

$$\tau_a = \frac{2(\epsilon\delta)^{\frac{1}{2}}}{v_a} \qquad (11)$$

(which is only approximate when B varies during the time τ_a). The maximum pulse time for which the magnetic field does not penetrate appreciably through the tube wall, according to equation 8, is:

$$\tau_{do} = \frac{2\pi^2\delta^2}{\eta} \qquad (12)$$

If the tube is formed against a metal mandrel, we must have $\tau_a < \tau_{do}$, to avoid a magnetic "cushion."

If the mandrel is made of insulating material the time required to fill the cross-section with flux is:

$$\tau_{di} = \frac{2\pi R\delta}{\eta} \qquad (13)$$

and the more lenient condition $\tau_a < \tau_{di}$ applies. Since the characteristic times τ_a and τ_d have a different dependence on physical dimensions, the condition $\tau_a < \tau_{do}$ (or τ_{di}) imposes a condition on the minimum size l_m of a sample that can be formed by a given magnetic field. This condition is roughly:

$$l_m > \frac{\eta\rho^{\frac{1}{2}}}{B} \qquad (14)$$

For copper we have $\eta\rho^{1/2} \sim 5000$ gauss-cm, which is not very restrictive. For stainless steel, however, the figure is 300,000 gauss-cm, so that samples less than 1 cm become difficult to handle.

The total energy requirements for magnetic forming can be calculated as the sum of the mechanical work E_w done on the sample, plus total field energy E_m present at the time of impact of the sample on the die, plus joule heat E_j that has been dissipated.

If the duration τ of the magnetic field pulse is comparable to the dynamic time τ_a (see equation 11), then both E_w and E_m amount to roughly:

$$\frac{B^2}{8\pi}\epsilon A$$

where A is the surface area of the sample and ϵ is the displacement during forming. The joule heating E_j is given roughly by

$$\frac{B^2}{8\pi} s A$$

The s factor is developed in equation 8. The joule heating will normally be negligible compared with the other contributions, provided $\tau << \tau_{do}$.

For B = 200 kilogauss and ϵ A = 100 cc, we have thus a total energy requirement of about 30,000 joules. •

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Commerce and Defense Departments disagree

Machine tool exports to Russia hit snag

The export license for shipment of 45 high-precision automatic grinders to Russia by Bryant Chucking Grinder Co has been permanently revoked by the Commerce Department. This comes just about a year after the original license was issued, and follows an on-again-off-again routine that has confused the manufacturer, other interested builders, government agencies, and probably the Russians themselves.

Final revocation came after a hearing before the Senate Internal Security Subcommittee, which had taken up the matter when objections to shipment had been voiced by Miniature Precision Bearing Inc, Keene, NH, and the Defense Department. Reportedly, the final decision was made at the White House level, over objections of certain Commerce officials.

Commerce had originally issued a shipping license to Bryant in March 1960 (*AM/MM* — Feb 22 '60, p87) Previously (in 1958) grinding machines of the type Bryant was to ship had been removed from the COCOM (Positive) List, meaning that the U S and its allies could now ship such machines to Russia.

In July 1960 Bryant received the order and immediately went into production of the machines. Then, in January 1961, the export license suddenly was suspended and manufacture was stopped. On February 6, the license was reinstated and production was resumed. But on March 2 the license was permanently revoked.

Subcommittee report

The Senate subcommittee's report said that "we are convinced that the decision to grant the license was an error in judgment which stems from a more basic error in procedure." The report referred to a letter from former Commerce Secretary Mueller on January 18 which pointed out that the original license was granted on evidence that the Russians could procure comparable machines elsewhere, and that Russian utilization of the machines would not represent a significant strategic hazard to the U S.

The only result of a denial of the license, said Mr Mueller, would be to withhold a business opportunity from a member of a particular American industry. Secretary Hodges, on February 9, strongly backed Mr Mueller's stand.

During the hearing the subcommittee questioned whether Commerce had had at its disposal the best expert opinion, then listed three points of conflict that had developed between Commerce and Defense Departments during the hearings:

- Bryant machine was termed unique by Defense and by Miniature Precision Bearing Inc.
- Its function is of critical importance in mass production of high-precision miniature bearings.
- Possession of the machines would enable Russia to make smaller and better missile guidance systems, gyros, and other military items.

Expert testimony

The Senate subcommittee took testimony from twelve independent experts, among others. Testimony established conclusively, the report said, that no machines comparable to the Bryant grinders (model B Centalign) can be obtained from other sources, that the Soviet has not mastered problems in mass producing miniature bearings, that Russian industry is plagued by poor quality and obsolete equipment, that with its own resources it would take Russia years to develop the capability, and that possession of the Bryant machines would accelerate greatly Soviet mastery of the art of miniaturization.

Expert witnesses included top production and engineering men from New Departure, Barden Corp, and Fafnir; the assistant director of the Instrumentation Lab at MIT; and consulting engineers from Konet Co and Franklin Institute. Four European builders of machines supposedly comparable to the Bryant grinder (Minganti in Italy, UVA in Sweden, Studer in Germany, Voumard in Switzerland) supplied data that led the subcommittee to conclude that none of them actually had comparable machines.

The report said that Bryant "acted in good faith," in arranging for export of its grinders and in delivering its plans in advance of shipment according to established procedure. (Bryant supplied the Russians with certain plans for assembly of the grinders.) In the future, companies should wait, the subcommittee report recommends, for actual shipment of machinery before sending assembly plans or other data.

Defense offers to buy machines

The Defense Department has offered to buy the Bryant machines for the Navy. But Navy doesn't need them and presumably the 45 machines could hang over the market, in that they could be offered as surplus at any time. Rumor has it that Bryant may be able to work out a plan with Defense whereby the latter will take some of the machines and Bryant will market the rest.

The final decision to revoke the license does not sit well with some government people. One official comments that it is a misfortune that both sides are not being told.

Sharpness of the conflicting Commerce and Defense Department testimony is believed to be exaggerated. For one thing, superiority of the Bryant machines, acknowledged by Commerce, is not significant compared with other available machines. Other complaints that are made are that Commerce people were not allowed to cross-examine Defense witnesses; that the subcommittee reported the "opinions" of individual experts and not their collective testimony; that Commerce does not even know what questions Defense experts were asked.

A defense of Bryant

Springfield (Vt) Chamber of Commerce's Legislative Action Committee has issued a five-page defense of Bryant. It asks that both sides of the case be presented to the public. It also voiced alarm over lack of concern in Congress about the future of the machine tool industry.

Other exports studied

Representative Glenard P Lipscomb (R, Calif) has urged that export licenses for high-production machine tools for Russian auto plants be suspended. He states that the Commerce Department last year au-

thorized, in several cases, shipment of "highly strategic machines" used in manufacturing V-8 engine blocks and heads. He asked the Defense Department for a report on the licenses, and he says he was told that the products of these transfer-type machines were "clearly of military value, and that the technology contained in the transfer machines produced in the U S is the most advanced in the world."

According to Lipscomb, Commerce in 1960 authorized exports of $6.11 million worth of automotive production equipment. The Cross Co has a license for export to Russia of about $5 million worth of transfer machines, but as yet has received no order from Russia. Licenses on these machines and on about $800,000 worth of gear hobbers expire in June and July of this year.

Latest developments

Senator Kenneth B Keating (R, NY) has proposed that Defense be given veto power on issuance of export licenses for material which might endanger U S security. Keating would give Defense power to reject rulings by Commerce, with the President reviewing cases in which the two departments disagreed on findings.

Keating, a member of the Senate Internal Security Subcommittee, has called for a thorough investigation of all exports of strategic materials to Russia since the end of World War II, and at the moment has his own staff gathering this information. •

N/C measures shop efficiency

Nothing ever offered to manufacturing management reveals such a clear, complete picture of a company's shop organization as the installation of its first numerically controlled machine tool.

This is the opinion of Peter Rusnov, one of 15 speakers at ASTME's Automation and Numerical Control Seminar, held last month in Hartford, Conn. Rusnov is chief industrial engineer of Cleveland's Warner & Swasey Co, a firm which not only has nine numerically controlled machine tools at work and three more in the installation stage, but which offers numerical control systems of its own for sale.

N/C planning at Warner & Swasey, Rusnov said, was done in three stages: design engineering, manufacturing planning, and production. With 110 engineers in the design department, N/C activity is coordinated by a design review committee which meets weekly for about three hours. The committee consists of one person each from design engineering, industrial engineering, quality control, and the shop. To the degree that these functions are coordinated before the advent of N/C, much of the immediate success of the committee will depend.

From an engineering standpoint, numerical control offers greater freedom of design, with many of the conventional manufacturing limits removed.

Because the language is fundamentally numerical, the engineer can convey the engineering requirements to the shop with greater clarity. He can be less concerned with how the part will be made than how it is to *function*. Dimensioning, however, is more important than ever before and the designer's specification of tolerances and finish will determine feeds and speeds. His responsibility for ultimate performance increases.

Manufacturing planning takes on the largest share of responsibility, but usually requires the least change of organization. First, at Warner & Swasey, only new parts were studied for numerical control programming. Then, conventionally made parts reviewed for economic justification and in the light of existing tooling and standard lot size.

Criteria for selecting a N/C system were described by Lee B Musser, Atlantic Regional Manager, Industrial Controls Section, The Bendix Corp.

"Don't," he warned, "buy a drilling machine with numerical positioning control just because it's simple and easy to learn on if you can't justify it in terms of drilled holes. Buy only equipment that will pay its way."

N/C builder services

In addition to the characteristics of the machine-and-control combination, such as accuracy, location of zero, type of drive, method of data input, and compatibility of tape format, Mr Musser urged the prospective purchaser to inquire about the broader services. How much field experience has the builder had, to assist in solving problems? Does the builder offer a training program? Can the purchaser depend on a nationwide maintenance service to minimize downtime? Downtime, nowadays, should be well under 10%.

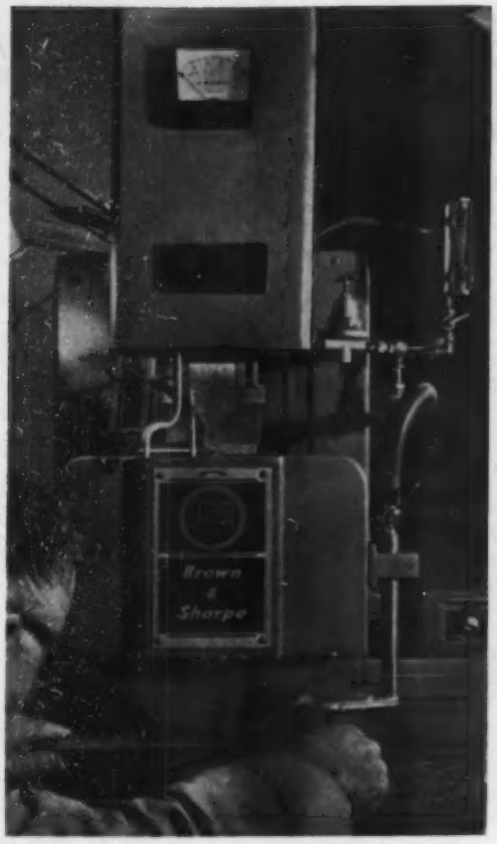
R C Brooks, Eastern Regional Engineer with Westinghouse Air Brake Co's Industrial Products Div described how modern pneumatic devices can fit into automation. Pneumatic controls are of two types, he said: Line, or "off-on" control and modulated or pressure control. Systems are divided, for the sake of planning, into senders, modifiers, and receivers. The trend now is to small senders plus relays to supply large amounts of air, or large forces, at the point of application.

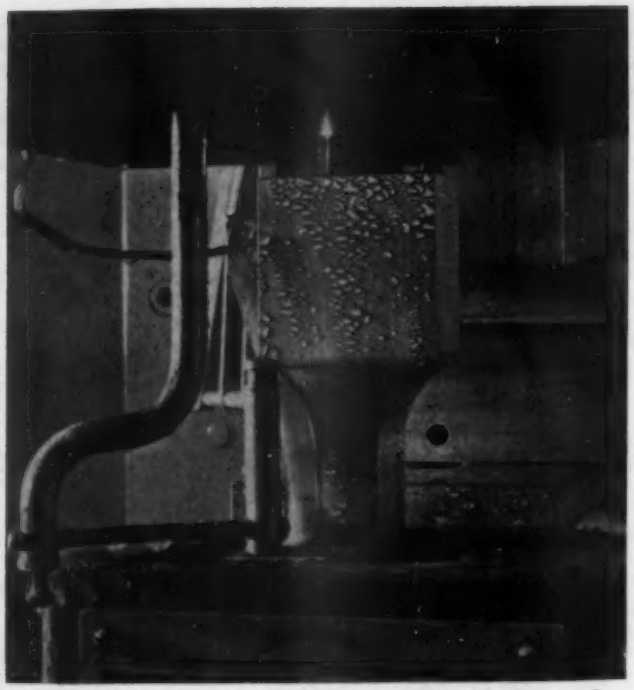
Logic circuitry is now quite common with pneumatic controls, Mr Brooks pointed out.

The need for greater compatibility among numerical control programming forms was brought out by H L Tholstrup, Instrument Engineer with Commercial Controls Corp. With a variety of the forms supplied by manufacturers of numerical control equipment, he showed how the location of support information, first information into the tape, etc, differed. **A standard, well-planned form, he said, would not only increase typing and tape preparation speed but would further reduce the danger of errors.** Now, a programmer must learn to use many different forms.

Two varieties of continuous contouring were described by C P Gure of Wyman-Gordon Co and R D Keller of Pratt & Whitney Co. The intricacies of programming a die block, with cutter-center offsets in three directions, were outlined by Mr Gure.

The Pratt & Whitney Co has 24 numerically controlled machines in production at its plant in West Hartford. Mr Keller described with many examples how the continuous path numerically controlled Keller machine had proved itself most efficient on simple parts—some parts that would ordinarily be assigned to a positioning machine. However, with simple computer programming and fast tape preparation, this machine has proved most efficient. •





Ultrasonic head mounts right on top of grinding wheel on surface grinder (left). Coolant flows into the aluminum head (shown in close-up, right) where it picks up a reciprocating motion. This cavitating coolant hits the wheel and prevents loading. Gage over head gives a mechanical reading of tool reciprocation

Ultrasonics ups grinding efficiency

Ultrasonic vibrations introduced in the coolant on surface and cylindrical grinders produce effects that:
• Prevent loading • Lengthen wheel life • Improve finish

By James Peacock, assistant editor

"This has taken all the tough grinding jobs and made them run-of-the-mill."

"It adds a new dimension to surface grinding."

"The process is quite attractive, and gives distinct benefits."

These comments from the field are about the Ever-Grind. Its primary part is a tool head, about the size of a deck of cards, that is placed a few thousandths away from the cutting surface of a grinding wheel. Coolant flows through the head, which is connected to a transducer, and then sprays onto the wheel while vibrating at 20,000 cps.

Engineers at Cavitron Equipment Corp, Long Island City, NY, were looking for a way to prevent wheel loading when they devised the attachment. It does this—and more.

The new attachment also greatly reduces wheel wear and improves surface finish two to four times over what it would be under the same conditions but without the attachment. Also, because there is no loading, the "sticky" materials like brass and aluminum are easier to grind.

For example: In a plunge grind on a piece of brass (Rh 45B) a Norton 38A320J8V wheel removed 0.0472 in. with no measurable wheel wear while maintaining surface finish of between 2 and 4 microinches rms throughout the cut. The test was stopped at that point, but "indications were that more material could be removed without affecting finish or increasing wheel wear."

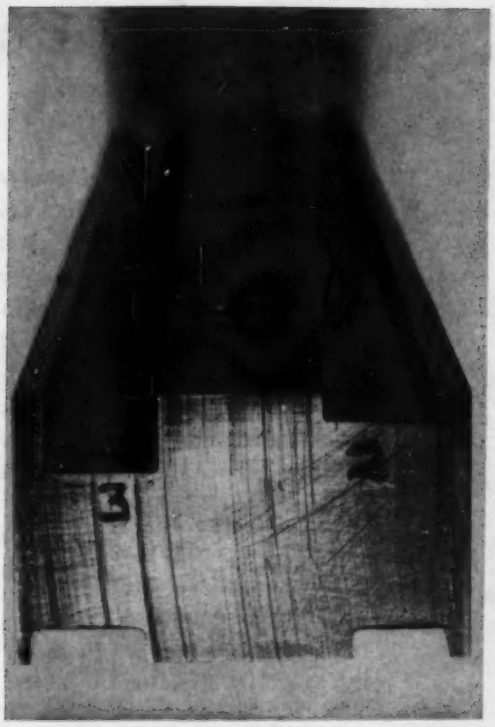
What is this attachment?

According to Dr Lewis Balamuth (the Cavitron VP for R&D who, with President Arthur Kuris, headed up the research team), the new application is very simple in theory:

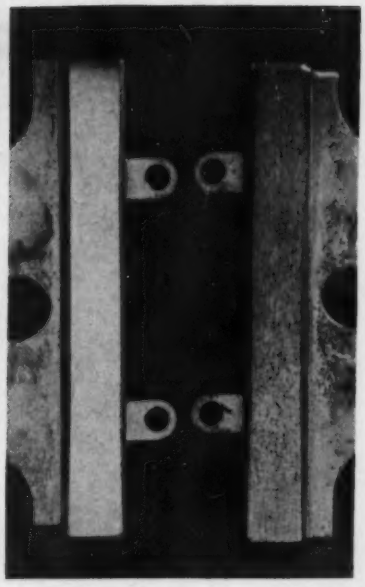
"We use our power source, or generator, to drive our motor, or transducer. This motor is attached to an aluminum head placed very near the grinding wheel. After the wheel is dressed, the coolant flows through the head, picks up a reciprocating motion, flows over the grinding wheel, and prevents its loading up.

"However, we aren't completely sure why the wheel wear is reduced and the finish is improved."

Cavitron has theories, he says, but the fact remains that these effects



Two plunge grinds on 303 stainless with 32A60K8VG wheel show effect of using Ever-Grind. Grind marked (3), with unit on, removed 0.337 in. with surface finish of 35 micro-in.; wheel is practically clean and doesn't need dressing. Grind (2) to a depth of 0.127 in. (without Ever-Grind) gave 60 micro-in. finish. Wheel is loaded and chattering; no further grinding is possible without dressing. Three wheel samples (right) show (T to B) wheel—newly dressed; after plunge (2); after plunge (3)



Two parts from production test by leading maker of data processing equipment show difference in finish with and without the attachment. A thin (0.040-in.) formed steel part had a ⅜ x 2-in. boss which had to be ground to ± 0.001 in. and hold 90 micro-in. finish. With a Norton 38A60J5VBE wheel, finish was 10 micro-in. with Ever-Grind, 120 without. Chatter was a problem which attachment overcame. It ground 308 parts in less than 8 hr on one dressing

occur. "Quite often the best part of an invention is the unexpected side effect."

How does it work?

The aluminum heads have openings in the side, through which coolant enters, and smaller holes in the bottom (next to the grinding wheel) through which the coolant sprays onto the wheel. The head is lowered until it is less than 0.010 in. from the wheel's cutting surface, and then reciprocates at the stroke for cavitation at 20,000 cps.

The reciprocating and cavitating coolant coupled with the rotating wheel sets up a complex set of physical conditions which produce a very effective force field at the wheel surface. This prevents loading.

And the wheel runs cool and clean. Reason: Without loading, there is no weld effect at the cutting surface. This both minimizes friction and keeps the abrasive grains sharp. This condition, in turn, eliminates most of the heat that causes the wheel to wear. **As a result of these conditions, the grinding wheel can operate past its load-up point, and on up near its glaze point, where the abrasive begins to get dull. This is what adds so much to the effectiveness of surface grinding.**

What are the results?

Heads for the Ever-Grind are available for grinding wheels of ½, ¾, 1, 1½, and 2-in. widths, and have been evaluated by several plants in the New York area. The net result of the various effects described is to increase grinding production, and a few examples should illustrate:

• At Lycoming Div of Avco Corp, Stratford, Conn, a piece of the superalloy A-286 was ground with a Peninsular FA60K9VB, at the same feeds and speeds, both with and without the Ever-Grind. Results:

	Time	*Dressing cycle*
Normal	14.4 min	twice per part
Ever-Grind	10 min	once per 16 parts

During the normal test (without Ever-Grind), the wheel was dressed because of chatter on the work rather than loading or burning.

• Grumman Aircraft Engrg Corp, Bethpage, LI, NY, achieved extraordinary surface finish on two large pieces—a 12-in. diameter vacuum plate made of 304 stainless, and a 12-in.-square Meehanite plate. Using Anti-sept No. 65 coolant, and a National MA80L10V6W wheel, they removed 0.004 in. of stock and achieved 4 micro inch finish, with "no loading of the wheel or burning of work."

While grinding a magnesium part at Grumman, operator Paul Lieb forgot to turn on the Ever-Grind. "The wheel felt like it needed dressing immediately," he says. "After I redressed the wheel, and turned on the unit, the machine ran the rest of the day without dressing."

Any drawbacks?

Admittedly, the Ever-Grind is not a panacea for every surface grinding problem; it is, however, another variable that often has advantages.

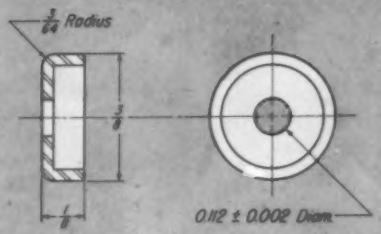
For high production jobs, the lessened wheel wear should shorten machine down time and cut the cost of diamond dressings and wheels.

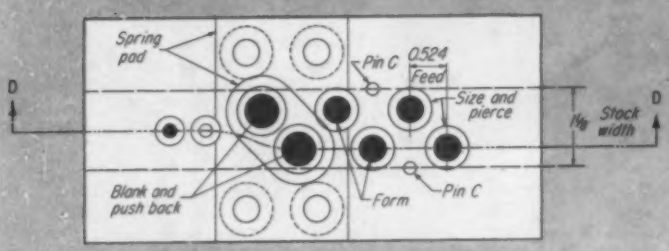
In many cases, it appears to give finishes previously attainable only with lapping or honing. •

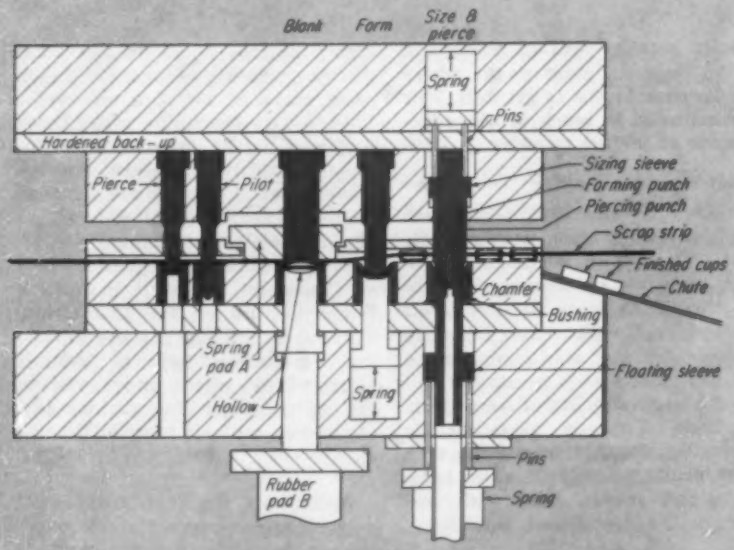
Two "impossible" drawn parts

John Woodman Higgins Redesign Award Winner for 1961

85.4% saving—As stamped, the steel sound nut cost $1.75 per thousand. Estimates for screw-machine part average $12 per thousand







SECTION D-D

No feed fingers—The strip carries the blank, then the cup, through a two-row progressive die. Blanking punch and push-off pin are hollow ground to concentrate pressure at periphery of blank when returning it to the strip. At last station the floating sleeve is level with the die at top stroke

This week the Pressed Metal Institute will honor two New York tooling engineers at its Annual Technical Meeting in New York: the first for making a part as a stamping which would normally be made by another method; the second for "a spectacular accomplishment that does not fully meet contest rules"

John Woodman Higgins Redesign Award . . .

Primarily, this award is made for an unusually capable substitution of a stamping for a part or assembly made by other methods. The judges may make the award on the basis of originality in design of the stamping or the tooling.

For 1961, the award will be made to Emil Loeffel, tool engineer, HK Metalcraft Mfg Co, New York, on two grounds: (1) willingness to consider stamping for a piece that is "obviously a screw machine part," and (2) successful design of a two-row progressive die that employs a new concept and also saves material.

The part is a cup-shaped steel sound nut only ⅜ in. in diameter. Wall thickness is 0.040 in., side wall height is only 0.080 in., and the bottom radius is 3/64 in.

Study of the drawing reveals stamping problems. For example:

A combination blank and draw die cannot be used because the blanking punch will have a very thin wall, and the part made on such a die will not have a sharp inner radius. Nor is it possible to progressively draw, size, pierce and blank without forming an undesirable ridge at blanking.

No feed fingers

The successful progressive die eliminates need for feed fingers, and there is no connection between the cup (which must be shallow) and strip.

Therefore, the part can be blanked and returned to the strip, then

win 1961 stamping awards

drawn and returned to the strip, then pierced, sized and returned to the strip. Parts that are smaller than the blanked hole can be transferred from station to station by the strip itself.

This method has its limitations, but it can be employed for a number of jobs which are either stampings now, or could be stampings—because the prohibitive cost of second operations is eliminated.

Die features

Pierce and pilot stations establish the feed. Then the correct diameter is blanked and pushed back into the strip by pads *A* and *B*. In the next station, the blank is formed into a cup and is again pushed back into the strip. The cup is then pushed to the next station by the strip, which is held above die level by pins C.

At the piercing and sizing station, means are provided to "float" the cup down into the chamfered die bushing. At top stroke, the cup lies somewhere within the blanked opening in the strip and rests upon a floating sleeve that is level with the die opening.

With ram movement, the floating sleeve is pushed down in timed relationship to the sizing sleeve. The latter does not actually touch the cup at this stage, but leaves it free to move sideways and adjust itself to the chamfered die bushing.

Finally, when the floating sleeve bottoms, the sizing sleeve reduces the cup height by 1/64th, the forming punch sets the radii, and the piercing punch pierces the central hole. Two limit switches are connected in parallel and timed so that the press shuts down if two cups are caught in the sizing station.

History of Award . . .

Seven years ago the John Woodman Higgins Redesign Award was established by the Worcester Pressed Steel Co., Worcester, Mass, to highlight the economics realized by substitution of stampings for castings, forgings, plastics and screw-machine parts. Winners have saved their firms over $3 million to date. Their accomplishments were summarized by Carter C Higgins, president of the donor firm, in an article "The Case for Stampings," (AM/MM—April 18 '60, pIII).

Special award . . .

Until this year, stove and range tops have always been supplied with separate burner bowls and trim rings. The industry has been forced to pierce openings for the bowls, because no one has been able to draw wells in a panel without wrinkling the connecting material.

Samuel Jacobowitz, tooling supervisor, Welbilt Corp, Maspeth, N Y, now has a one-piece top in production. The panel has four drawn wells, each with an annular ring that replaces the trim ring.

Result: costs are at least 65% less than for multi-part construction, and the appearance of the new range top is a strong selling feature.

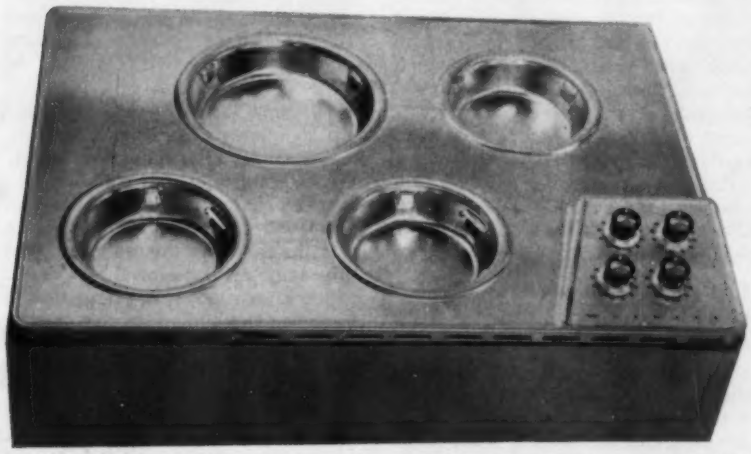
The Committee voted a Special Award to Jacobowitz in recognition of a spectacular accomplishment that did not fully meet the contest rules. Before the new tooling was completely developed, he "played it safe" by making sand-cast aluminum prototypes, intending to go into production of a die-cast, one-piece top if necessary.

Three dies are set up in a 300-ton mechanical press with 60 x 144-in. bed area. The first die draws the four wells with plenty of radius at bottom and top. The second die defines the bottom of each well and produces an annular rim that simulates the replaced separate trim ring. The third die trims and pierces. Production is about 350 pieces/hr.

The dies are designed for the most severe case—drawing enamelling iron with 0.002% carbon content without rupture. Metal for the draws is borrowed from the surrounding sheet. Thinning of the 0.049-in. stock amounts to 0.004 in.

Numerous problems of press tool design and setup had to be solved. The pressure pins must be level, and they are checked to 0.001 in. Die faces must be parallel. A patent application will be made on tooling and method.

The 25 x 33 x 0.049-in. blank is roller-coated with dry film lubricant (water soluble and no fat content) to a thickness corresponding to 125 mg/sq ft. The only scrap occurs when a sheet of enameling iron reveals a flaw at the first draw. •



No wrinkles—Despite "locked" draws, four burner wells are drawn in a Welbilt range top without producing wrinkles. The Special Award recognizes an accomplishment long sought in stove and range industry

Flame cutting for the small shop

How to do a big job with a small tooling cost. That's the prospect offered by this group of simple flame-cutting techniques that require minimum equipment and take up only a small amount of floor space

By Clement F Brown, production and methods engineer, Downingtown Iron Works, Inc, Downingtown, Pa

Even the hand torch can do accurate cutting with the help of a metal templet that locates the hole and guides the torch movement

For heavy cutting and fast metal removal, few methods can even approach the inexpensive process of flame cutting. It can produce accurately cut pieces in a wide variety of shapes—at low-cost and low operator fatigue.

With flame cutting, steel plates far beyond the capacity of any shear can be cut cheaply, and when the workpiece is large or cumbersome, portable equipment can readily be moved to the work. It's this portable, general-purpose equipment that often proves especially useful in the small or medium-sized metalworking shop, whether the shop is engaged in jobbing or production work.

Hand torch

Most any shop can find good use for a hand cutting torch. Finish cutting, rough cutting large pieces of stock prior to machining, maintenance operations, scrapping operations—these are a few of its applications.

With the aid of metal templets, an operator can cut holes and shaped parts to a surprising degree of accuracy. Often, he can remove large amounts of stock cheaply, leaving just enough material for machining.

Portable line-cutting machines

One of the least expensive pieces of mechanically guided equipment is the portable cutting machine. These machines usually weigh about 50 pounds and mount a single blowpipe, though a second is sometimes added.

This device, guided by lengths of steel track, makes straight cuts with either perpendicular or beveled edges. Attach a radius bar, and the same machine cuts circles of any reasonable size. It can also be set up for cutting off or beveling, with the machine operating on a fixed track or path.

For cutting heavy bar stock, burning is considerably faster than power sawing methods. Abrasive cutting is also fast, but flame cutting can easily handle heavier stock than the usual abrasive cutoff machine can.

When the workpiece dimensions are not critical, many cuts can be made with acceptable accuracy and surface finish, eliminating the need for finish machining. Average tolerances of ± 1/16 in. can be held with relative ease (up to 3-in. stock); tighter tolerances of ± 1/32 in. are often possible with added care. Closer tolerances than these should not be expected.

Cam-guided shape-cutting machines

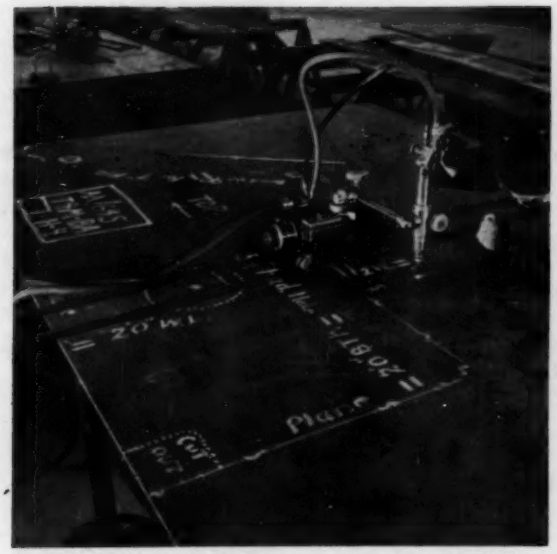
These machines can cut rectangles, circles, and practically any irregular shape within their cutting range—which is usually ample for the average shop's requirements. They come in several standard models and variations.

Some are semi-stationary; can be moved but are better suited for moving the work to the machine. Others are fully portable and can easily be moved to the work.

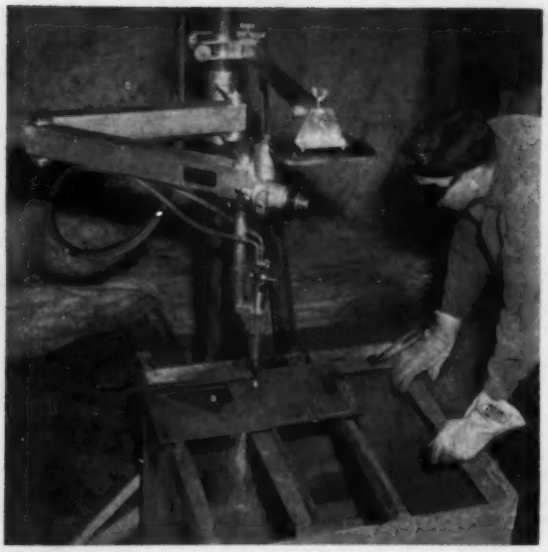
Torch-guiding techniques also vary. Many of these machines work with a magnetic tracing roller that operates against the edge of a steel cam. Others have a spring-loaded guiding head that operates against relatively inexpensive plywood or Masonite templets.

The cams for the machine shown on p129, lower-left, are made of ¼-in. steel. Regardless of the cutout shape, all these cams have one common feature: the centerline through the cam is located at a prescribed distance from the center of the mounting post—the same distance for all.

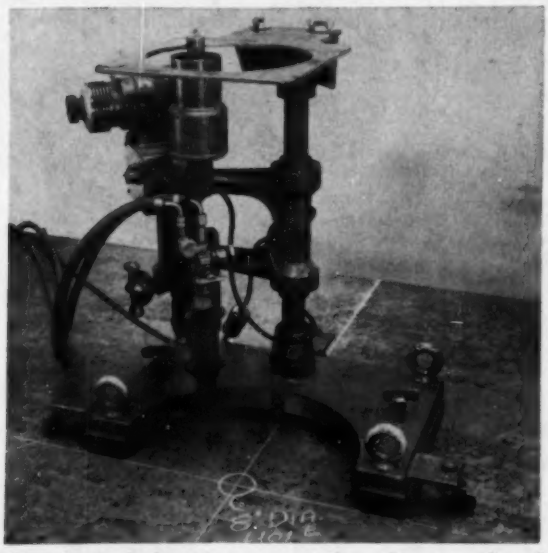
This dimension is the same as the distance from the mounting post to a line across the front faces of the base. Therefore, only the centerlines of the desired cut have to be laid out on the work. The front faces of the base are then placed on one centerline, and the pointer, which is aligned with the mounting post, is placed on the other.



Portable machine rides tracks to cut a series of straight lines for irregular pattern, can cut straight or beveled edges. When equipped with a radius bar, it can cut circles



Magnetic wheel is attracted to steel-plate cam: as wheel rotates, it follows contours of cam and guides torch through intricate cut. Other machines may have spring-loaded heads



Setup is simple here because centerline of cam is aligned with front faces of base. Special casters make machine more portable; pointed ends of wing screws lock it for cutting

Beam-type machine can make cuts over fairly large surfaces. Tracer wheel rides track for straight cuts; operator guides it for contours or uses metal cam for large orders

The same machine serves to illustrates how a few minor alterations can increase the versatility of semi-stationary equipment. First, the three casters, mounted on angles, were added to the machine's base to assist in moving from spot to spot and in locating precisely on the centerlines.

Second, pointed wing screws were installed in tapped holes in the base. By screwing these down until they exert a light pressure against the plate surface, the machine is kept from shifting after setup.

Wider range machines

Beam-type machines are limited only by the width of the area they can cover (usually about 3 feet). For length, they can cut any practical distance with additional sections of rail. The machine can be set on a stationary table as shown here, or it can be mounted right on a larger workpiece.

The tracing end of the beam is motor driven, and when cutting straight lines, the tracer wheel runs in a grooved track. Circles are made

either by attaching a radius bar to the wheel or by following a paper templet manually.

When cutting irregular shapes, the operator has to "steer" the tracing wheel along the outline of a paper templet. These templets are usually laid out on manila paper, and allowances have to be made for the width of the kerf.

Paper templets wear out

Though the paper templets work well for short runs, they have certain disadvantages for high-quantity production. The close concentration required for "steering" causes a fairly high operator fatigue. Too, the templets must be replaced frequently because of wear from the serrated traced wheel.

However, if the cutout is not too complex, a grooved metal cam can be made without difficulty. The figure at right shows a track cam for a production lot of 1-in.-thick steel links. The part, also shown, is 3½ x 9 in. A later operation calls for drilling a pair of 1 1/32-in. holes on 5½-in. centers.

Simple tooling technique

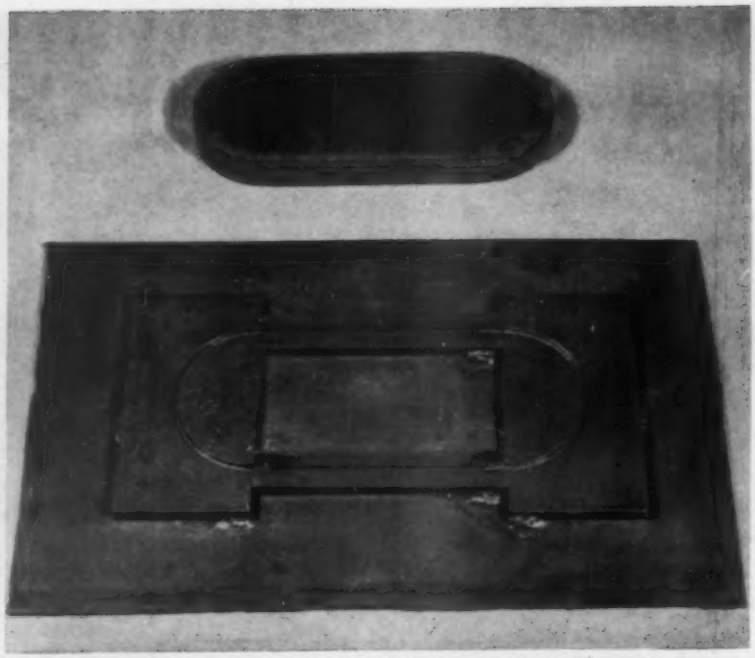
We made both ends of the cam by cutting a ⅛-in.-deep circular groove in a piece of ¼-in. plate and then cutting the plate into two halves. A 5/32-in. groove width permits the serrated tracer wheel to operate properly, and a diameter of 3⅞ in. allows for burning kerf.

The piece is split with a 1/16-in. saw cut and tack-welded to a base plate—correctly spaced by two straight sections of track. These sections are ¼ x 1-in. flat steel bar with a 5/64 x 1/8-in. groove milled down their length.

Note the clearance cut at the junction points (in the straight sections). This allows the guide wheel to enter freely from the circular to the straight track section.

Cams of this type can operate successfully if the minimum diameter does not restrict the guide wheel's action. On smaller diameters, the operator may have to guide the wheel around the arc manually to keep it from climbing out of the groove. Usually, though, this problem can be overcome by grinding a small radius on the leading edge of the guide wheel.

There are other kinds of burning equipment, of course, some of them quite elaborate. However, because of their special purposes or their high cost, they do not warrant serious consideration for the small shop. •



Metal cam (lower) guides tracer wheel of beam-type machine for production runs, saves wear and tear on paper layouts and on operator who would otherwise have to guide tracer wheel manually around the contours of the layout

Flame cutting data for mild steel

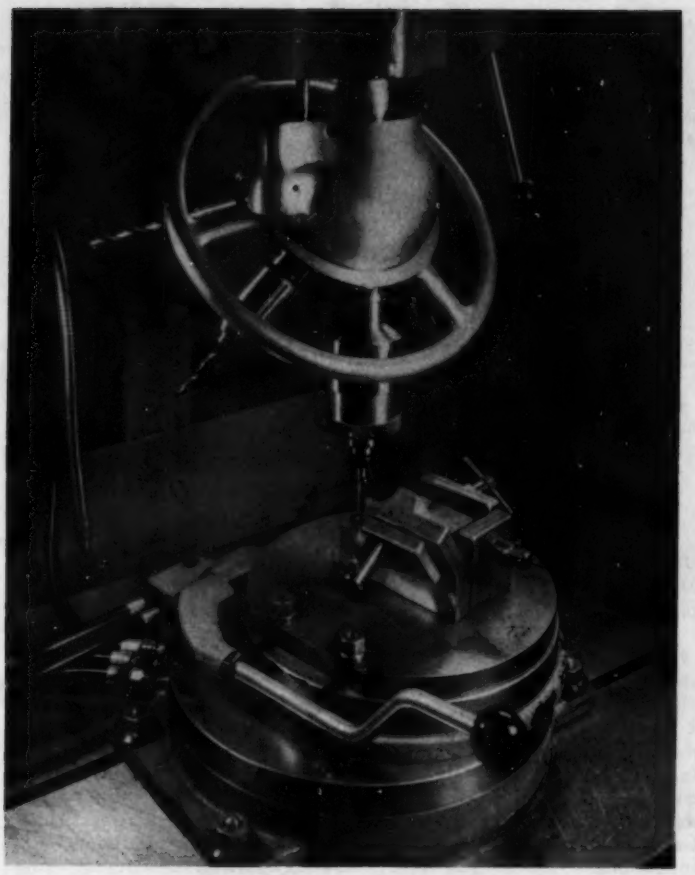
Plate Thickness (in.)	Average Cutting Speed (ipm)	Operating Pressure (psi) Oxygen	Acetylene	Consumption (cfh) Oxygen	Acetylene
⅛	20	30	3	50	9
¾	19	30	3	75	12
½	17	40	3	90	12
¾	15	40	3	120	14
1	14	50	3	140	14
1¼	13	60	3	160	14
1½	12	45	3	185	16
2	10	50	3	200	16
2½	9	50	3	250	17
3	8	45	4	310	22
4	7	60	4	385	22
5	6	50	5	460	28
6	5	55	5	495	28

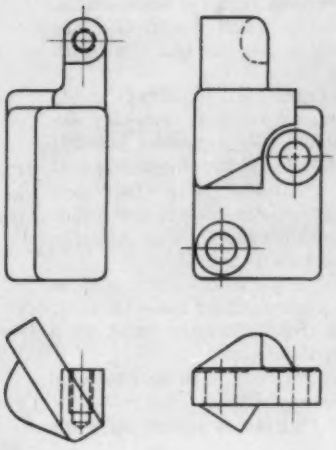
Notes:

(1) **All figures given are average recommendations. Many factors—plate temperature, surface cleanliness, cutting tip size, cut configuration, etc—have a bearing on specific recommendations.**

(2) **Variations in oxygen operating pressures (while consumption shows a continued rise) are related to increased cutting tip size.**

(3) **Acetylene operating pressures are largely a function of torch design, rather than plate thickness.**





Two pieces per cycle—Duplex fixtures for simple parts eliminate an index head. Pulley-block casting is put into right-hand side of fixture to produce two counterbored holes, then transferred to left-hand side of fixture for hole in inclined boss. When fixture is filled at both positions, one complete part is produced in a 1-minute, 15-second cycle

Tooling for turret drilling

Turret drilling has captured the spotlight as a faster, less expensive method of making holes. Here are recommendations for work-positioning devices and tools for five basic categories of machining problems

By Arnold Charlat, consultant,
Machine Tool Division
Brown & Sharpe Mfg Co.
Providence, R I

New tools for turret drilling, such as positioning tables, are fast taking the inaccuracy out of hole making. Up to now, hole making—whether it be drilling, tapping, counterboring, reaming, or a combination of these methods—has depended for positioning upon box jigs with guide bushings.

But box jigs have their drawbacks. For example, most of the work cycle is consumed in sliding the jig from spindle to spindle of a gang drill, or in getting the tool to enter the guide bushings without bending or breaking.

And because accuracy of hole location and squarenesse depend upon the guide bushings, tool life can be shortened as much as 90% if the tool and bushing abrade. Use of multi-diameter carbide tools is impractical, because of the excessive breakage which occurs if the tool axis and the bushing are misaligned.

Such shortcomings can be minimized by turret drilling, in which all spindles of the turret drill come accurately to the work, and work movements are short (equivalent to hole-center distances).

It is now possible to use positioning tables, which have an accuracy of movement to less than 0.001 in., so as to eliminate guide bushings altogether: Or if guide bushings *are* used, to extend tool life tenfold—simply because accurate positioning minimizes abrasion between tool and bushing.

To get maximum turret drilling efficiency, a tool designer must give full consideration to rapid, accurate work positioning, and to work orientation. These considerations are essential in setting up a proper tool sequence for the turret. Some others:

Avoid guide bushings

Most jobs permit a 0.005 in. variation in true position of holes. A drill can be expected to maintain position accurately within this tolerance when: (a) the tool is properly

ground and sharp, (b) the drill is started on a smooth clean surface square to the tool axis, and (c) the material (such as a casting) is not so porous that the tool will drift.

Improvement in accuracy of hole location can be achieved with short rigid spotting tools or the use of a boring bar to correct location, if the extra time can be tolerated and a guide bushing remains undesirable. It is better to specify multi-diameter tools than to use multiple slip bushings.

Advantages of avoiding guide bushings: easy chip removal, increased tool life, greater possible depth of hole, more efficient use of coolant, greater rigidity (from use of shorter, stiffer tools), and minimum clearance problems in indexing from one tool to another.

Of course there are circumstances when a guide bushing *must* be used:

- When the drill must start in a rough cast surface.
- If a cored hole is to be corrected with a core drill.
- If the tool is not square with the work.
- If a pilot support cannot be used when hollow-milling a hub.

In all such instances, bushing length should be 1½ times drill diameter. Space should be provided between the bushing and work equal at least to that of the drill diameter, so as to permit escape of chips. Alternatively, practically no space can be left—so that chips aren't trapped.

Use of tools

Multi-diameter carbide tools, if properly ground, are well suited to turret drilling, because the work is rigidly and accurately positioned.

Hollow mills should be supported by a pilot, if practical, or by a guide bushing.

End mills should always be bushing-supported.

Acorn dies should be set up in the same way as taps.

Combination drill reamers are effective on through holes if the tolerance is ± 0.001 in.

Subland drills cost little and effect substantial savings in production time—should be used to the fullest possible extent.

Half-round or fluted drills should be used for spotting easily machined materials, and as multi-diameter drills for brass. Straight smooth holes can be produced in brass with high accuracy—frequently eliminating need for reaming.

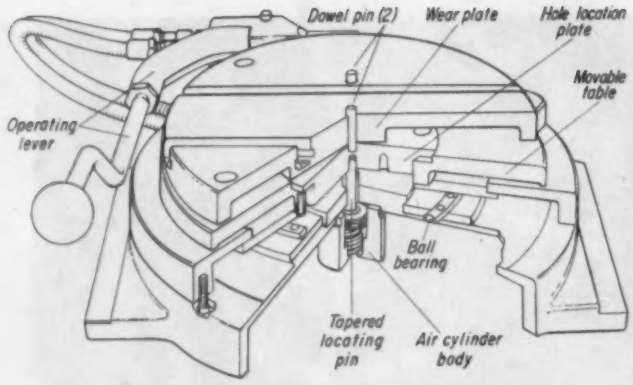
Boring bars should be used only when a guide bushing is not desirable, as when the machine has power feed. The hole is first roughed with a standard or core drill, leaving 0.005-0.015 in. for the boring bar to clean up, is then reamed for accurate sizing.

Bore reamers should be used on short through holes, so that the tool can be short and rigid.

Roller-burnishing tools are used after reaming to size a hole and improve its finish.

Recessing and grooving tools vary so widely in design that they should be used according to manufacturers' recommendations.

Coolant should flood the work, especially if carbide tools are used.



Circular positioning table—Upper section of table is moved about until tapered locating pin enters the desired hole in the hole-location plate. Dowel pins in wear plate register fixtures or tooling accessories with relation to the location hole

Positioning Tables

Two types of positioning tables are used with turret drilling machines: manually operated, and numerically controlled.

Manually controlled tables, are low in cost, easy to set up and exchange. A pattern of holes on the underside of a hole location plate conforms exactly with the pattern of holes to be produced in the part. The hole-location plate can be round for small work, rectangular for large parts. In either case, the basic principle of operation is the same.

The table consists of a movable portion (which rides freely over a predetermined area on ball-thrust bearings), a hole-location plate, an air-operated locking pin to align the table with the machine spindle for each operation, and a base fastened to the machine table.

To use the table, the operator depresses a lever to move from one hole center to another, sliding the movable portion of the table to the approximate hole center for the next operation. A locking mechanism then precisely locates the work, when the pin enters the hole in the underside of the hole-location plate.

Tape-controlled tables are power-operated in two coordinates by ball-bearing leadscrews and can be positioned to ±0.0005 in.

Index heads give considerable flexibility to turret drilling—especially for spacing holes in a bolt circle. The index head is used as a table in a horizontal plane when drilling holes in the face of a part, and vertically when drilling them radially.

In both applications, circular work is held in a 3-jaw chuck or collet chuck. If an irregular workpiece is to be oriented to present more than one surface to the drill spindles, the index head is fitted with a suitable fixture.

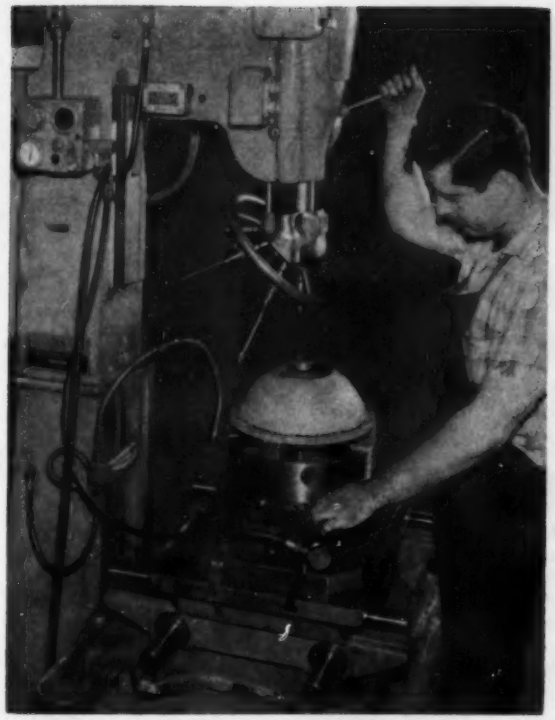
Concentric bolt circles are easily drilled with an index head and positioning table. The hole-location of the table is machined with one location hole for each bolt circle.

If power-operated index heads are used, the index motion must be interlocked with turret retraction. If indexing is under operator control, careless or accidental power indexing may seriously damage the machine spindle.

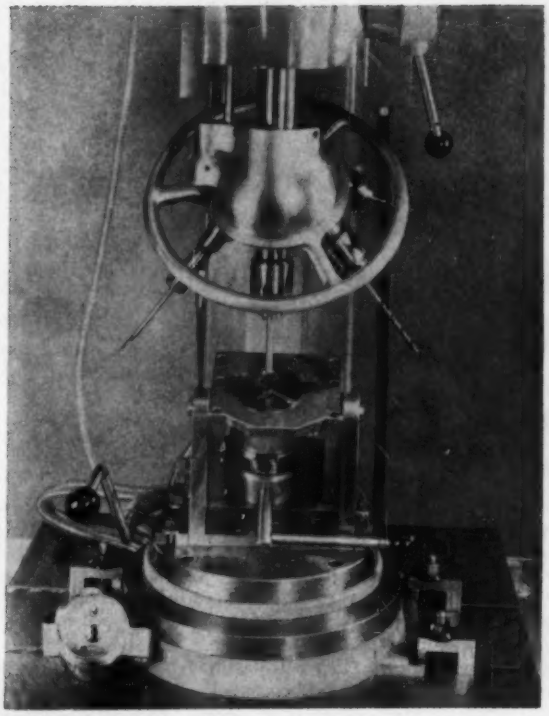
Trunnion fixtures will orient workpieces that cannot be handled conveniently on an index head. If an index head is mounted on a trunnion fixture, work can be oriented in two axes. And if this combination is applied to a positioning table, complex workpieces and hole patterns can be handled.

Tooling method sheet

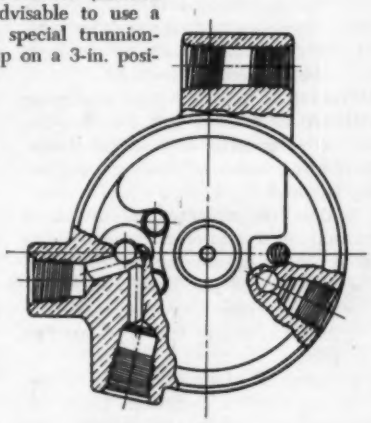
Only through a detailed analysis is it possible to set up the best sequence of operations to produce a



Holes at two levels—Two series of bolt holes are produced at levels 3½ in. apart. One hole-location plate is used for three different workpieces. In the operation shown, one hole in upper circle is in line with one hole in lower circle. When this location is found in the plate, the hole is drilled and tapped. The other holes are obtained with a Hartford spacer. Six holes in lower circle are likewise produced with the aid of the hole-location plate and the Hartford spacer



Bushing plate—When hole centers must be held to close tolerances (±0.002 in. or less), it is advisable to use a bushing plate. The special trunnion-type fixture is set up on a 3-in. positioning table



production part with minimum movement and tooling expense. Eight steps are involved:

- List all required tools.
- Attempt substitution of combination tools consistent with cost, availability and tool cost per piece.
- Develop logical tool sequences in groups of six operations (six is the maximum number for any one setting on the turret drilling machine).
- Decide the order of use of these tool groups—according to location points, intersecting holes, and dimensional relationships between groups of holes.
- Select workholding methods.
- Sketch the fixture.
- Work up a "Tooling Method Sheet." Entries on the form should list:
  - (a) Turret stations
  - (b) Work performed at each station
  - (c) Number of holes on which work is performed before indexing
  - (d) Spindle speed and feed at each station
  - (e) Time estimate in seconds for each operation
  - (f) An allowance to cover indexing time, work positioning and orientation, spindle advance and retraction, and loading and unloading the work

(With experience, the estimated total production time should come within 10% of the actual time).

- Estimate costs of fixture, hole-location plate and other needed equipment for the job.

Basic machining problems

Any sequence of six or fewer tools to produce a part falls into one of five basic categories:

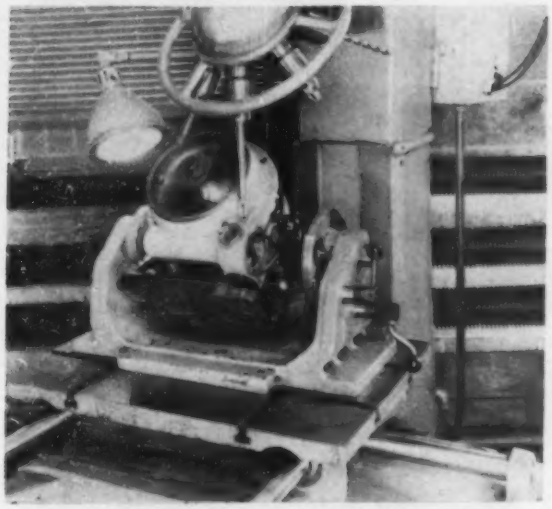
(1) A single-hole, no work movement required
(2) Multiple holes on one side of the work and in a common plane
(3) A single bolt circle
(4) Two or more bolt circles on the same side of the work, and
(5) More than one hole — more than one side of the work. Here work orientation is required.

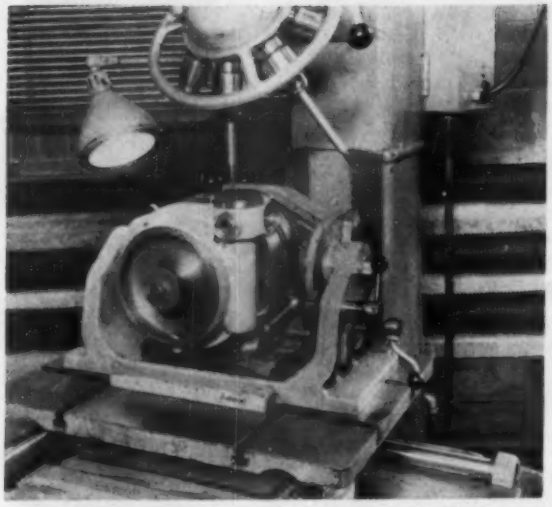
Single-hole locations

If a drill bushing is not needed, only a simple, inexpensive fixture is required. In such cases, the fixture should have a setup block with a reference pin or hole, which can be indicated to zero before clamping the fixture. If the fixture contains a guide bushing it can be indicated to zero.

Holes in a common plane

Two basic groups of work fall into





Three tooling elements—When "universal" movements are provided, it is possible to "work all around" a feature of the workpiece. Part is a wormgear housing. Tooling elements are: 10½ x 12 in. positioning table, trunnion fixture and Hartford spacer. (left) Three screw holes are drilled and tapped in one face of the boss. (right) Hartford spacer is indexed 90°, and trunnion fixture rocked backward 45° to work on a single hole. Other operations are done after indexing in one or more planes. No box fixture is required—only a faceplate-type fixture and a hole-location plate

another category of turret-drilling jobs:

(1) "Flat plate," which is relatively thin and reasonably uniform in thickness, and

(2) Complex castings or other constructions involving widely varying configurations.

The latter involves rigid clamping without distortion, and tool lengths and interferences caused by variations in elevation of the surfaces being worked.

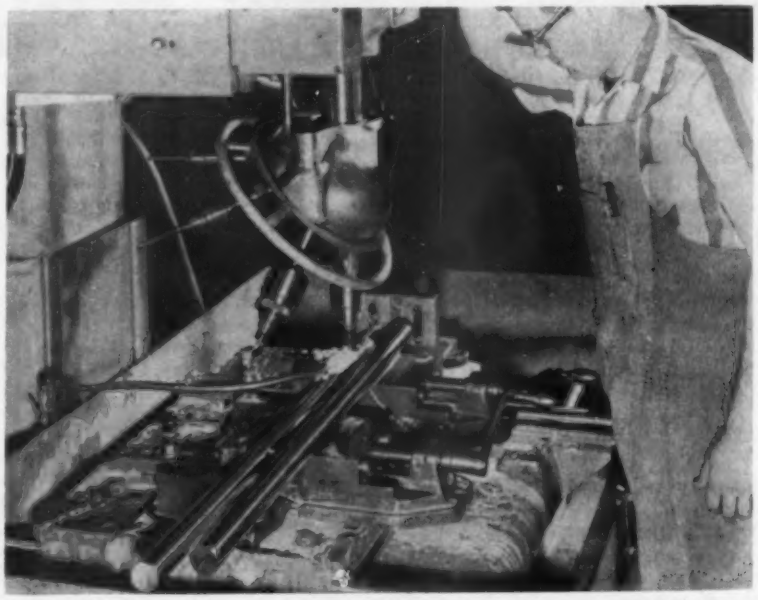
A decision on whether to use a manual or a numerically controlled table hinges on several factors:

- Number of parts per run. (Economics may favor a tape-controlled setup for a short-run job.)
- Number of holes in any plane. (Cost of a location plate increases with the number of holes. Overall cost of tape control may well be less.)
- If a work movement is confined to a single plane, it is well suited to tape control.
- Adaptability to automation varies with plant needs and the amount of capital that can be tied up. The low cost of simple fixturing should be balanced against capital investment for tape-control equipment.

If a manual table is selected, a fixture plate should be considered if a number of similar parts are to be processed. The hole-location plate of such a table is provided with two reference points, to which the hole pattern is related. These same reference points, or pins, can also locate a fixture plate. Thus, the part is readily superimposed on the hole pattern provided for it.

If more than one part can be handled by the same fixture, it is possible to superimpose the fixtures on the several hole patterns required—without creating confusion for the operator.

If parts have clean flat surfaces, the operator may have difficulty in learning the hole pattern. In such cases, a rubber stamp or stencil will guide him. •



No fixture—If there isn't time to build fixtures, a rectangular positioning table, two vises and an end stop can be used for positioning a shaft to machine a series of related holes. Brown & Sharpe puts 11 bottom holes in a 1½ in. shaft with an 0.080 in. case, without guide bushings, and within 0.003 in. of true position. Time: 10 minutes per shaft. Originally, the shop made four shafts per day on a miller

Pick the right

PAINT for the job

A quick guide to surface preparation, selection, application, and drying of paints for such varied uses as mass production of appliances and repainting of machine tools —along with a handy reference chart (see next page)

By J E Spector, vice president, Sun Chemical Co

Improvements in paint have come thick and fast in recent years. And while today's paints have color retention, adhesion, and a life expectancy far beyond those of, say, 20 years ago, it is also true that they have become highly specialized. As a result, the prospective user is confronted with a bewildering array of epoxies, alkyds, and synthetic-resin-base paints—to say nothing of cleaning compounds, primers and the like.

But because today's paints are tailored to the job as never before, they have opened up entirely new fields for painted metals. Concrete, stone, wood, and even stainless steel have given way to painted metal in many applications.

Which paint for which job? On the following page is a chart that not only answers this question but gives recommended surface cleaning methods, primers, preferred method of application, drying and/or baking.

Surface preparation

No single paint has yet been developed which protects *any* metal surface. Some paints, for example, will stand a lot of banging around, yet will break down quickly if exposed to ocean spray. Some paints are resistant to water, while others would scarcely last through one hard rain. One type of paint may be the best choice for the original finish on, say, a refrigerator, but an entirely different type may be more suitable for repainting the refrigerator.

Selection of the right paint is only the beginning, however. Surface preparation and drying methods can be equally important. Even the most experienced manufacturer of original equipment sometimes comes a cropper in the selection and application of paint.

For example, one manufacturer who couldn't make paint stick to his stampings found that faulty ventilation was introducing oil-laden air from a machining department into the painting area.

Another found that the painted surface of his products deteriorated rapidly out of doors. Reason: he had failed to apply a base coat of rust-inhibiting paint.

Surface preparation is the basis for any successful painting job. Here, two primary precautions must be taken: (1) that the base metal will retain the paint, and (2) that the surface is clean *at the time of painting.*

Tips on repainting

This does not always mean that every last visible remnant of old paint must be cleaned off a machine before applying the new, when repainting a piece of industrial equipment. On the contrary, in this instance it is preferable to abrade the old surface with a wire brush, steel wool, or a file to give the surface "tooth" to hold the new paint. A blow torch is definitely not recommended, but sometimes when a surface is curved, it must be hand-abraded with abrasive cloth or even sandblasted.

Repainting calls for a thorough degreasing of the surface *just before painting*, not a few days before.

Choosing a paint

First consideration in the selection of a paint, whether for mass production of such items as appliances, automobiles, machine tools or what have you—or for repainting equipment—is surface.

For example, a machine tool requires a coating which is flexible, does not break readily, and which is virtually immune to penetration of oil and water. Phenolated alkyd paints are recommended for this.

Machine tools obviously require a far different kind of paint than, for example, a metal wall clock, where finish is more important than durability. And end products which must withstand even more abuse than machine tools, or are subject to highly corrosive environments, need still another type of paint—rubber-based.

Whatever the paint, it is essential that it go over a primer coat with which it is chemically harmonious. If a primer and top coat are chemically hostile to each other, the finish will break down quickly—as the top coat lifts away from the primer, or in other words, peels off.

The epoxies

Cost, of course, enters into the selection of the right paint for a given job. This is especially true with epoxies, which while they achieve a highly adhesive surface that is impervious to bad climatic conditions and most corrosives, are expensive.

They also must be mixed on the job (although epoxy ester paints are modified with oil to eliminate this) and tend to harden quickly in the mixing pot. For these reasons, the end use should be worth the extra cost and the added inconvenience of mixing.

The chart on the following pages is perhaps applicable to 90% of all problems of applying paint to metal. It is, however, a basic guide. Special problems, especially those involving high production painting, should be carefully worked out with paint manufacturers' representatives to insure maximum surface life, ease of application, and minimum cost.

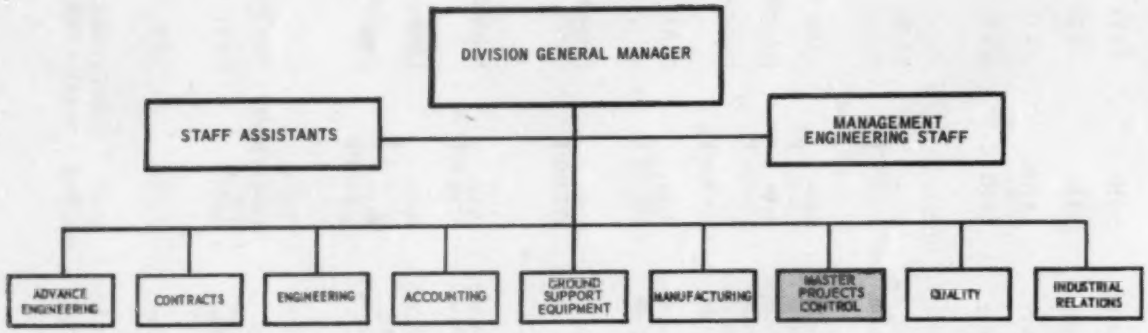
(See chart on next page)

Guide to paint selection and application

	SURFACE PREPARATION	PRIMER COAT	TYPE OF FINISH	NO. COATS	METHOD OF APPLICATION	DRYING TIME	APPROX LIFE EXPECTANCY
CONSTANT EXPOSURE—OUTDOORS							
1. **Top-abuse**—Cutting, pushing, lifting, scuffing, etc.	Remove all loose scale, rust, and foreign matter.	Polyamide Epoxy	Polyamide Epoxy	Prime & 1 coat	Brush, Roller, Spray	2-4 Hr	5 Yr
2. **Medium-abuse**—guard rails, covers, housings, etc.	Remove all loose scale, rust, and foreign matter.	Epoxy	Epoxy	Prime & 1 coat	Brush, Roller, Spray	2-4 Hr	5 Yr
3. **Occasional-abuse**—switch panel doors, light standards, etc.	Wire brush surface, remove all loose matter.	Containing Keytoxine Compounds	Industrial enamel	Prime & top coat	Brush, Spray	4-6 Hr	2-3 Yr
4. **Weathering only** — iron grillwork, metal canopies, light hoods, etc.	Wire brush surface, remove all loose matter.	Containing Keytoxine Compounds	Industrial enamel	Prime & top coat	Brush, Spray	4-6 Hr	2-3 Yr
5. **Construction Equipt**	Wire brush or sandblast.	Enamel undercoat	Alkyd enamel	Prime & 2 top coats	Brush, Spray	4-6 Hr	1-2 Yr
MARINE							
1. **Metal parts** on shore, exposed to salt spray.	Remove all loose scale, rust, and foreign matter.						
2. **Metal parts** exposed to fresh water.	Wire brush. Remove all loose material.	Rubber base	Rubber base	Prime & 2 top coats	Brush, Spray	4-6 Hr	1-2 Yr
3. **Boats**—submerged or exposed parts.	Clean as possible.	Chlorinated rubber	Chlorinated rubber	2 Coats	Brush, Spray	1-2 Hr	1-2 Yr
INDOOR PLANT AND OFFICE EQUIPT AND FURNISHINGS							
1. **Storage facilities,** lockers, closets.	Wire brush, remove loose particles.	Enamel undercoat	Alkyd enamel	Prime & top coat	Brush, Spray	4-6 Hr	3-5 Yr
2. **Materials handling equipment,** rough use.	Wire brush, remove loose particles.	Enamel undercoat	Alkyd enamel	Prime & 2 top coats	Brush, Spray	4-6 Hr	2-3 Yr
3. **Floor trucks,** cranes, other powered equipment.	Wire brush, remove loose particles.	Enamel undercoat	Alkyd enamel	Prime & top coat	Brush, Spray	4-6 Hr	3-5 Yr
4. **Components** subject to scuffing—elevator doors, kick plates, shelf surfaces, metal stair treads.	Remove loose matter, wash with mineral spirits.	Epoxy	Epoxy	Prime & top coat	Brush, Roller, Spray	2-4 Hr	2-3 Yr
5. **Machine Tools**	Wire brush, remove loose particles.	Enamel undercoat	Alkyd enamel	Prime & top coat	Brush, Spray	4-6 Hr	3-5 Yr
6. **Large surfaces**—grillwork, metal partitions, canopies.	Remove loose matter, wash with mineral spirits.	Epoxy	Epoxy	Prime & top coat	Brush, Roller, Spray	2-4 Hr	2-3 Yr

ATMOSPHERIC ABUSE							
1. General acid—plating rooms, textile finishing, electrolytic processes.	If possible—sandblast.	100% Solids[1] epoxy	Cut top coat 20%	Prime & top coat	Brush, Spray	2-4 Hr	3-4 Yr
2. Alkali—Salt Spray.	If possible—sandblast.	100% Solids[1] epoxy	Cut top coat 20%	Prime & top coat	Brush, Spray	2-4 Hr	3-4 Yr
3. Fine abrasive particles—grinding, milling.	If possible—sandblast.	100% Solids[1] epoxy	Cut top coat 20%	Prime & top coat	Brush, Spray	2-4 Hr	3-4 Yr
4. Petroleum—petro-chemicals, coal and coke products, organic residues.	If possible—sandblast.	100% Solids[1] epoxy	Cut top coat 20%	Prime & top coat	Brush, Spray	2-4 Hr	3-4 Yr
FABRICATED METAL PRODUCTS							
1. Severe outdoor exposure.	**Degrease and** chemical **etch.**	Rust inhibitor, zinc chromate or chromate-oxide	Alkyd or Alkyd-melamine	**Prime & finish coat**[2]	Spray, flow, dip, roller, curtain	Bake 275-350°F	2-5 Yr
2. Expendable containers.	Remove visible dirt & grease.	None	Alkyd or Alkyd-urea	1 Coat	Spray, flow, dip, roller, curtain	Bake 275-350°F	1 Year +
3. Flat surfaces.	Degrease.	None	Alkyd-urea or Alkyd-melamine	1 Coat	Spray, flow, dip, roller, curtain	Bake 275-350°F	Indefinite
4. Deep-drawn and curved surfaces—precoated. Deep-drawn and curved surfaces—after coated.	Degrease.	None	Alkyd-urea or Alkyd-melamine	1 Coat	Spray, flow, dip, roller, curtain	Bake 275-350°F	Indefinite
5. Sanitary products—often-cleaned surfaces in restaurants, kitchens, laboratories.	**Degrease and** chemical etch.	Epoxy or phenolic rust inhibiting chromate-oxide	Epoxy, vinyl, Polyurethane, Polyester	Prime & 1 Coat	Spray, flow, dip, roller, curtain	Bake 275-350°F	2-5 Yr
6. Rigid metal goods—castings, forgings.	**Degrease and** chemical etch.	Rust inhibiting chromate-oxide	Alkyd-melamine, Alkyd-urea, or Epoxy	**Prime**[3] Spot Fill Intermediate Finish	Spray, dip	Bake 275-300°F	Indefinite
7. High temperature exposure.	**Degrease and** chemical etch.	Silicone-Alkyd or straight Silicone	Silicone-Alkyd or straight Silicone	1 or 2 coats	Spray, flow, dip, roller, curtain	Bake 375-450°F	Indefinite
8. Low temperature exposure.	**Degrease and** chemical etch.	Vinyl rust inhibiting type	Vinyl	Prime & 1 coat	Spray, dip, roller, curtain	Bake 250-275°F	Indefinite
9. High-gloss surface.	**Degrease and** chemical etch.	Sanding type rust inhibiting chromate-oxide	Alkyd-melamine or Alkyd-urea	**1 to 2 coats**[4] primer, 1 finish	Spray, curtain	Bake 250-300°F	Indefinite
CONSUMER GOODS							
1. Toys, for non-toxic finish.	Degrease.	None	Lead-free alkyd or lacquer	1 coat	**Spray, dip,** roller, curtain	Bake or force dry	Indefinite
2. Toys, for scuff and bruise resistance. Expendables: pails, mops, inexpensive tools.	Wash and clean as well as possible.	None	Lead-free alkyd enamel	2 coats	Brush, spray	2-4 Hr	1-2 Yr
3. Metal furniture—indoor, outdoor.	Wire brush. Remove rust and loose matter.	None	Lead-free alkyd enamel	2 coats	Brush, spray	2-4 Hr	1-2 Yr

[1] *A new coating which cures by oxidation.*
[2] *Three-coat system recommended for severe exposure.*
[3] *Sand and bake between coats for best results.*
[4] *Bake and sand primer for best results.*



Staff function—but with line authority. Under this setup the Master Projects Control Group can break bottlenecks and take effective action when trouble occurs. Both verbal and written reports on any project's progress go to the division manager

This "Task Force" gets things done!

Production bottlenecks, red tape, and excessive costs go sailing out the window when Lear, Inc's six-man "Task Force" pitches in on a tough contract—cutting across established engineering and production levels

By George H DeGroat,
associate editor

What is the best way to control—from contract stage to delivery—really complex orders, when volumes are low and runs are short?

One solution: Create a "project control" team and give it the authority to do these tasks:

- Eliminate production bottleneck
- Keep tabs on costs at any stage
- Keep management posted on the progress of projects
- Most important of all, see that projects are finished on time

This setup works beautifully at the Instrument Division (Grand Rapids, Mich) of Lear, Inc. Here a six-man task force has the authority to cut across all levels to get things done.

The group operates as a *staff* function reporting directly to the division general manager but has *line* authority. It gets into the picture at the very outset of any major project, when contract requirements are being discussed, and follows the project through until the goods are ready for delivery.

The organization chart (above) shows how the group operates as a staff function. On the opposite page, a typical engineering and production schedule shows how the task-force team rides herd on critical projects, from contract go-ahead to completion.

Why a project team?

In the past, conventional procedures at Lear were good, but officials realized they would not be good enough for the future. Demands for greater precision were on the rise, and the company's products (especially those built under defense contracts) were becoming much more complex.

Too, management knew that it had to eliminate time losses and inefficiencies in transitional stages between getting a contract, designing and engineering the project, and manufacturing and assembling the components. Today, for instance, some projects cover as many as 600 components; the old way of doing things simply would not work now. From a study of these problems came a "master project control" system, headed by a group of six men—all of them experienced in engineering, design, tooling, and manufacturing.

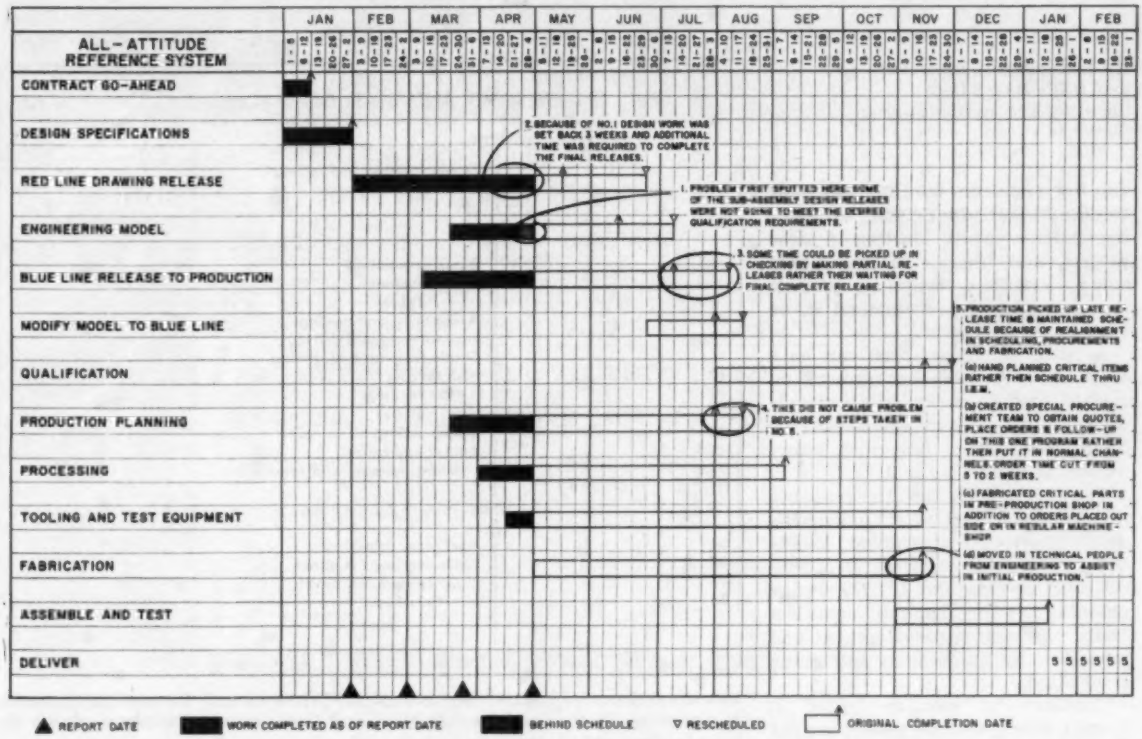
This team does not attempt to cover every job in the plant, but concentrates on controlling critical projects that are really complex. When the number of these projects is exceptionally large, other specialists are assigned, on a temporary basis, to the group.

Fast action possible

Although integrated with conventional production-control systems at Lear, the new system permits effective, immediate action not possible with the ordinary methods. The team can approach key personnel in all plant areas to plan and review projects, define problems, fix responsibility, and measure progress.

As a result, it can outline any number of projects to the division manager in detail, or single out one particular project from hundreds for discussion. Top management thus receives regular reports simply and easily, from one man, rather than having to hold lengthy meetings, or call in several people from several departments. In a company that makes a wide range of products—including complicated control systems for aircraft and missiles—these up-to-date reports are of extreme value to management.

ENGINEERING AND PRODUCTION SCHEDULE


JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
ALL-ATTITUDE REFERENCE SYSTEM
CONTRACT GO-AHEAD
DESIGN SPECIFICATIONS
RED LINE DRAWING RELEASE
ENGINEERING MODEL
BLUE LINE RELEASE TO PRODUCTION
MODIFY MODEL TO BLUE LINE
QUALIFICATION
PRODUCTION PLANNING
PROCESSING
TOOLING AND TEST EQUIPMENT
FABRICATION
ASSEMBLE AND TEST
DELIVER
2. BECAUSE OF NO. 1 DESIGN WORK WAS SET BACK 3 WEEKS AND ADDITIONAL TIME WAS REQUIRED TO COMPLETE THE FINAL RELEASES.
1. PROBLEM FIRST SPOTTED HERE. SOME OF THE SUB-ASSEMBLY DESIGN RELEASES WERE NOT GOING TO MEET THE DESIRED QUALIFICATION REQUIREMENTS.
3. SOME TIME COULD BE PICKED UP IN CHECKING BY MAKING PARTIAL RELEASES RATHER THEN WAITING FOR FINAL COMPLETE RELEASE.
5. PRODUCTION PICKED UP LATE RELEASE TIME & MAINTAINED SCHEDULE BECAUSE OF REALIGNMENT IN SCHEDULING, PROCUREMENTS AND FABRICATION.
(a) HAND PLANNED CRITICAL ITEMS RATHER THEN SCHEDULE THRU I.E.M.
(b) CREATED SPECIAL PROCUREMENT TEAM TO OBTAIN QUOTES, PLACE ORDERS & FOLLOW-UP ON THIS ONE PROGRAM RATHER THEN PUT IT IN NORMAL CHANNELS. ORDER TIME CUT FROM 9 TO 2 WEEKS.
(c) FABRICATED CRITICAL PARTS IN PRE-PRODUCTION SHOP IN ADDITION TO ORDERS PLACED OUT SIDE OR IN REGULAR MACHINE-SHOP
(d) MOVED IN TECHNICAL PEOPLE FROM ENGINEERING TO ASSIST IN INITIAL PRODUCTION.
4. THIS DID NOT CAUSE PROBLEM BECAUSE OF STEPS TAKEN IN NO. 5.
5 5 5 5 5 5
REPORT DATE
WORK COMPLETED AS OF REPORT DATE
BEHIND SCHEDULE
RESCHEDULED
ORIGINAL COMPLETION DATE

Scheduling problems in engineering and production are charted as they occur, so that steps can be taken to solve them. Here a design problem was spotted in the engineering model late in April. This delayed designing by three weeks (item 2), but some of the lost time was regained by partial instead of full releases to production (item 3). Item 5 details procedure followed to put project back on schedule. All critical projects in the company receive this close attention

Planning projects

At the first notice of contract go-ahead, the project-control team begins its work, by studying the requirements for a project. Then, to ensure realistic scheduling and to uncover potential bottlenecks, the group discusses the project with design engineers. Here they talk about costs and design schedules, as well as problem areas and any other factors that may affect project planning.

From these conferences comes the entire engineering schedule, from preliminary to final design drawings. Schedules are set up for each stage of this work, and get checked regularly. If they are not maintained, the reasons for lags are discovered early, so that the team can provide whatever help is necessary. And in every instance, the group has the authority to go right to the heart of the matter, and to correct any condition that affects the project schedule in any way.

In all other phases of the project, the team follows the same procedure. There are pre-planning conferences with tooling and manufacturing people, and with assembly, inspection, and testing groups. Here, too, realistic schedules are set up and carefully watched.

The "Engineering and Production Schedule" reproduced here shows the various project stages over which the team rides herd. Notice that a problem spotted in the "Engineering Model" stage, about one-third through the project, was later corrected by making adjustments, so that delivery dates could be met.

Close tabs are kept on costs, too. Forecasts are made, showing complete details, on engineering, scheduling, production, assembly, inspection, testing, and any other cost area.

Solving bottlenecks

Wherever problems arise, the group moves in to eliminate them. If suppliers of materials, tools, or parts do not make expected deliveries, the reasons for the hold-ups are determined, and the team takes appropriate action. If manpower, time, or even money is short in manufacturing, assembly, inspection, or other areas, steps are taken to relieve the situation.

In short, once schedules have been set up, nothing is allowed to interfere with them. And the project-control team also monitors estimated costs for all phases of a project. Thus the project manager is aware, when costs do not reflect normal activity, that work has been held up. Moreover, he also knows that, when costs go beyond normal, trouble has occurred.

Thanks to this close control, nothing about a project gets overlooked, because careful overseeing detects trouble areas at once, so that plans can be made to handle them. And because *the team has the authority to break up any bottlenecks*, it can act swiftly and decisively. •

Patents—a technical gold mine!

By J R Paquin, supervisor
Tool & Die Design Dept
Cleveland Engineering Institute
Cleveland

Too few engineers take the time and trouble to look into existing or pending patents when starting a new project, and because of this either come up with a design or product that has little to recommend it, or with an infringement.

A little patent research can go a long way. A solid background on related patents—their origin, development, and present status—can be highly rewarding. And such information is easily available.

The U S Patent Office has probably the greatest collection of engineering information ever assembled, classified for easy access. Here, in 2,600,000 U S patents and 157,000 design patents, are the fruits of countless hours of research, development and invention by many men and many good minds.

Contrary to popular belief, it doesn't take a trained patent lawyer to unearth related patents, nor to understand their contents. True, a patent *is* a legal document, but its two most important sections (Part 1—purpose of the invention, and Part 2—structure and method of operation) are readily understandable, while Part 3—legal claims—can be ignored in a search for information. And liberal and complete illustrations, plus detailed descriptions make a patent easy to understand with a little practice.

A search for patents in a particular field of interest involves four steps:

1. Classification manual

A copy of the "Manual of Classification of Patents" is available from most public libraries, or may be obtained by writing the Superintendent of Documents, U S Government Printing Office, Washington 25, D C. Price: $6. This large, looseleaf book lists all patent classes and subclasses.

All patents, other than design patents, are classified under 346 main groupings, called "Classes." These are identified by number and title, for example:

"Class 1, Nailing, Stapling, and Clip Clenching." But obviously this class (and all classes, for that matter) contains far too many patents for quick and easy searching. For this reason, each class is broken down into a number of "Subclasses." Example:

"Class 1, Nailing, Stapling and Clip Clenching—Subclass 43, Lath and Shingle Nailing."

In this manner, all fields of knowledge are broken down into small, easily researchable units. There are 44,000 subclasses in all. Thus when the two or three subclasses that cover a particular subject are found, only a relatively small number of patents need be studied to obtain complete information.

Design patents are classified in much the same way—with 93 main classes, each identified by title, number and the prefix "D" to denote design patents. These main classes are in turn divided into subclasses for more specific aspects of a design. Example:

"Class D-1, Advertising—Subclass 3, Card Racks and Receivers."

Using the indexes

On page XII of the "Manual of Classification of Patents" is a listing of the 346 Classes—arranged by divisions of the Patent Office that examine them. There are 70 such divisions in all.

NAILING AND STAPLING MACHINES

	Book
7	Staple forming and setting
8	Staple setting
	Box
8.1	Blank assembling
8.2	Wire bound
8.3	Tables
14	Assembling and nailing
9	Nail forming and driving
11	Staple forming and driving
10	Nail driving
16	Nail feeding
15	Tables
13	Staple setting
13.5	Basket and barrel
13.6	Staple forming and setting
	Shoe
34	Heel plate attaching
32	Fastening heels to shoes
35	Crosshead and turret
36	Crosshead
	Etc.

Subclass lists occupy most of the "Manual of Classification of Patents." This portion of a page on "Nailing and Stapling Machines" shows how the subclasses divide the main heading into minute parts

On page XXIII of the Manual, the Classes are arranged in numerical order, and on page XIX they are arranged alphabetically.

2. Classification bulletin

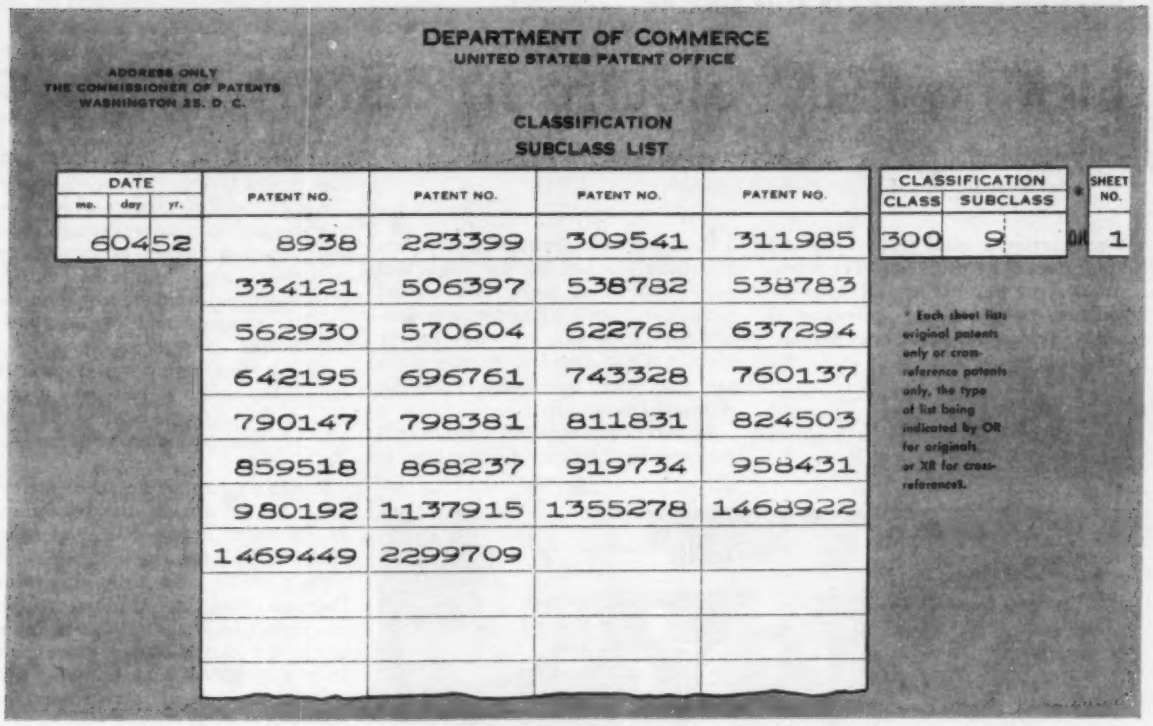
Next step, after determining which Class you are interested in, is to order the "Classification Bulletin" for that class from the Patent Office. The cost is nominal. These bulletins elaborate on the subclass information in the "Manual of Classification," where only bare titles are given. These Bulletins also point to patents of interest in other classifications.

3. Subclass lists

Then, as the next step in researching patents, copies of "Subclass Lists" for each subclass in which you have an interest may be ordered from the Patent Office. These typewritten lists (Cost: 20¢ per sheet) give the numbers of all patents in each subclass. By selecting those patents you want, you can avoid the danger of buying patents useless to you, even though they are in the same subclass.

4. Ordering the patent

Next, examine the actual patents at the nearest library which is a depos-



DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE

ADDRESS ONLY
THE COMMISSIONER OF PATENTS
WASHINGTON 25, D. C.

CLASSIFICATION
SUBCLASS LIST

DATE mo.	day	yr.	PATENT NO.	PATENT NO.	PATENT NO.	PATENT NO.
6	04	52	8938	223399	309541	311985
			334121	506397	538782	538783
			562930	570604	622768	637294
			642195	696761	743328	760137
			790147	798381	811831	824503
			859518	868237	919734	958431
			980192	1137915	1355278	1468922
			1469449	2299709		

CLASSIFICATION CLASS	SUBCLASS	*	SHEET NO.
300	9	OR	1

* Each sheet lists original patents only or cross-reference patents only, the type of list being indicated by OR for originals or XR for cross-references.

A patent subclass list (see Step 3) gives all the numbers of the patents in the subclass at time of issue. Armed with those numbers you can examine the actual patents at a library designated as a patent depository

itory for patents (See listing on this page). Check off those needed for your files and order the patents direct from the Patent Office by title and patent number. Printed copies of any U S patent cost 25¢ each (postage free), and design patents are 10¢ a copy.

Payments may be made in several ways: Postal money order, certified check, or with 25¢ coupons issued by the Patent Office in books of 20 for $5, or 100 for $25. Postage stamps will not be accepted in payment. All inquiries should be addressed to the Commissioner of Patents, Washington 25, D C. A separate letter should be written for each inquiry.

Other patent services

It pays to keep up with new patents in your field. This can be done by consulting the last page of the weekly *Patent Gazette*, which is available at most public libraries, or a subscription may be ordered.

As another of its services, the Patent Office will forward you patents soon to be granted in subclasses relating to your subject. A deposit must be made, and there is a charge for this service. Details are available from the Patent Office's Patent Copy Sales Branch.

Libraries containing collections of patent copies

Albany, N Y	University of State of New York
*Atlanta, Ga	Georgia Tech. Library
Boston, Mass	Public Library
Buffalo, N Y	Grosvenor Library
Chicago, Ill	Public Library
Cincinnati, Ohio	Public Library
Cleveland, Ohio	Public Library
Columbus, Ohio	Ohio State University Library
Detroit, Mich	Public Library
*Kansas City, Mo	Linda Hall Library
Los Angeles, Calif	Public Library
Madison, Wis	State Historical Society
*Milwaukee, Wis	Public Library
*Minneapolis, Minn	Public Library
Newark, N J	Public Library
New York, N Y	Public Library
Philadelphia, Pa	Franklin Institute
Pittsburgh, Pa	Carnegie Library
Providence, R I	Public Library
St. Louis, Mo	Public Library
Toledo, Ohio	Public Library

* Collections incomplete

Suction pump aids in slot sinking

Licking EDM electrode distortion

By Dean T Wall, planning engineer, and Daniel Strack, instrument maker, Special Materials Shop, Argonne National Laboratory*

The narrower and deeper the cut, the greater the problems. This statement—true for almost all types of cutting—is especially germane to EDM (electrical-discharge machining).

Here a critical problem is electrode distortion, caused by the heat that builds up when gases and eroded metal particles are trapped and cannot readily be carried away by the coolant. Consequently, cutting rates are low, and electrodes must be changed frequently.

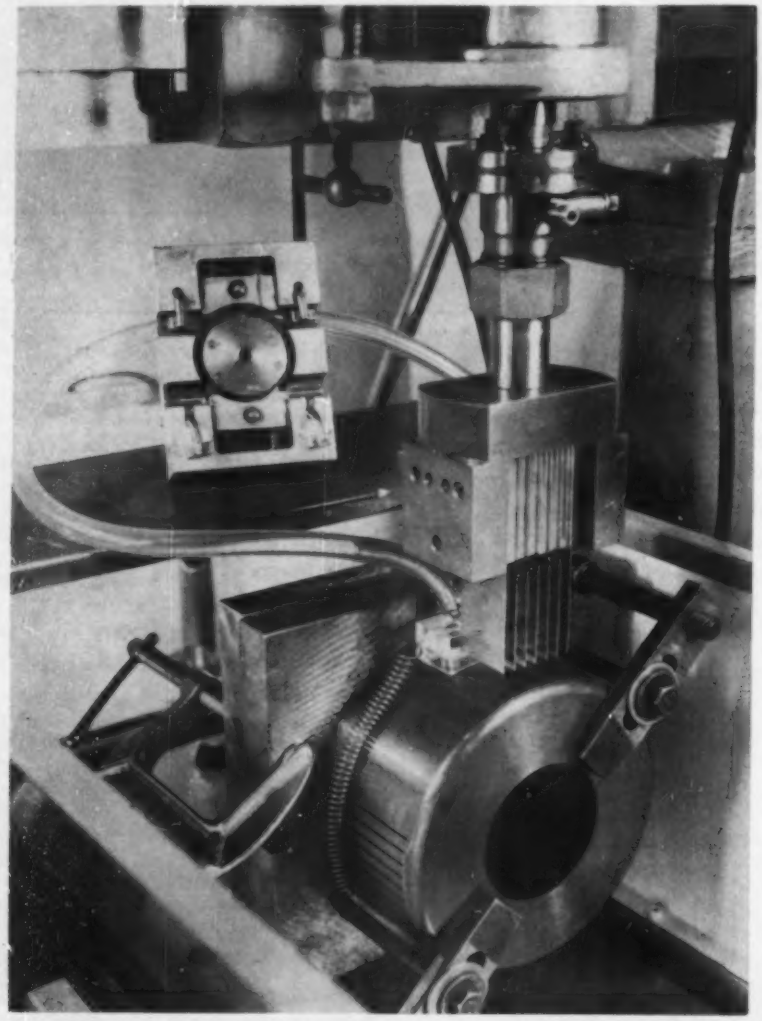
At Argonne National Laboratory, we have devised an effective way to overcome this handicap: *Use a suction pump to draw the coolant past the electrodes.* In the machining of narrow precision slots (described below), suction flushes gas and metal particles away from the cutting area much more efficiently than natural or pressure flow of the dielectric coolant.

The suction pump speeds up the operation, reduces the cost of producing the slots, and simplifies the job of holding tolerances on the workpieces.

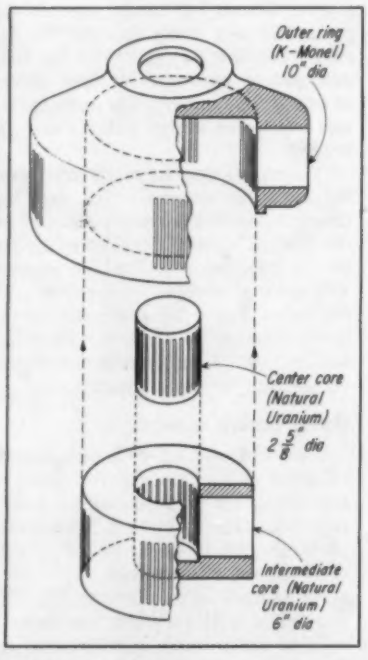
Electrode distortion had always been a problem in the machining of neutron chopper rotors (see sketch). Built for research, the solid-section rotor has 2-in.-long slots (tapered from 0.45 in. down to 0.15 in. wide) in both natural-uranium cores and the K-Monel outer ring. (For a detailed discussion on machining the first of these rotors, see *AM*—Aug 12 '57, p105.)

From the beginning, heat distorted the electrodes during horizontal

* Argonne National Laboratory is operated by the University of Chicago for the U S Atomic Energy Commission



For roughing out precision slots, seven electrodes feed vertically into the work. Suction pump (rear) pulls out gas and eroded metal particles through a plastic tube. Suction is produced by action of six rollers (on periphery of pump rotor) against the tube. See cover for horizontal-feed finish-machining setup



Neutron chopper rotor has center and intermediate cores of natural uranium, a K-Monel outer ring. In all three components, sets of seven tapered slots must be machined

feeding to rough and finish the slots.

To machine the slots, we adapted an Elox M-500 vertical-spindle machine for horizontal cutting operations. A servo-motor drive, with appropriate gearing, was added to the table leadscrew, and these were connected to the regular vertical feed controls.

To precisely locate the flat 65-35 yellow-brass electrodes, we developed special holders and guide fixtures. The coolant-electrolyte was piped to two pierced holes, mounted horizontally above and below the electrode plates at the front end of the guide block.

Despite the extreme care we took in making setups, and in selecting electrode plates, the plates warped. Cutting rates were low and electrode change frequent.

Recently we received an order to make a second rotor, of slightly different design. Remembering the electrode problem, we made a critical review of the original slot-machining tools and setup. From our research came a new technique.

Slots roughed vertically

First of all, we decided to rough out the slots in the solid workpieces vertically, instead of horizontally. When a blind slot is sunk vertically, gas produced by the cutting arcs rises from the workpiece and carries with it some of the eroded particles of metal. The cutting rate therefore is faster than with horizontal slot-sinking.

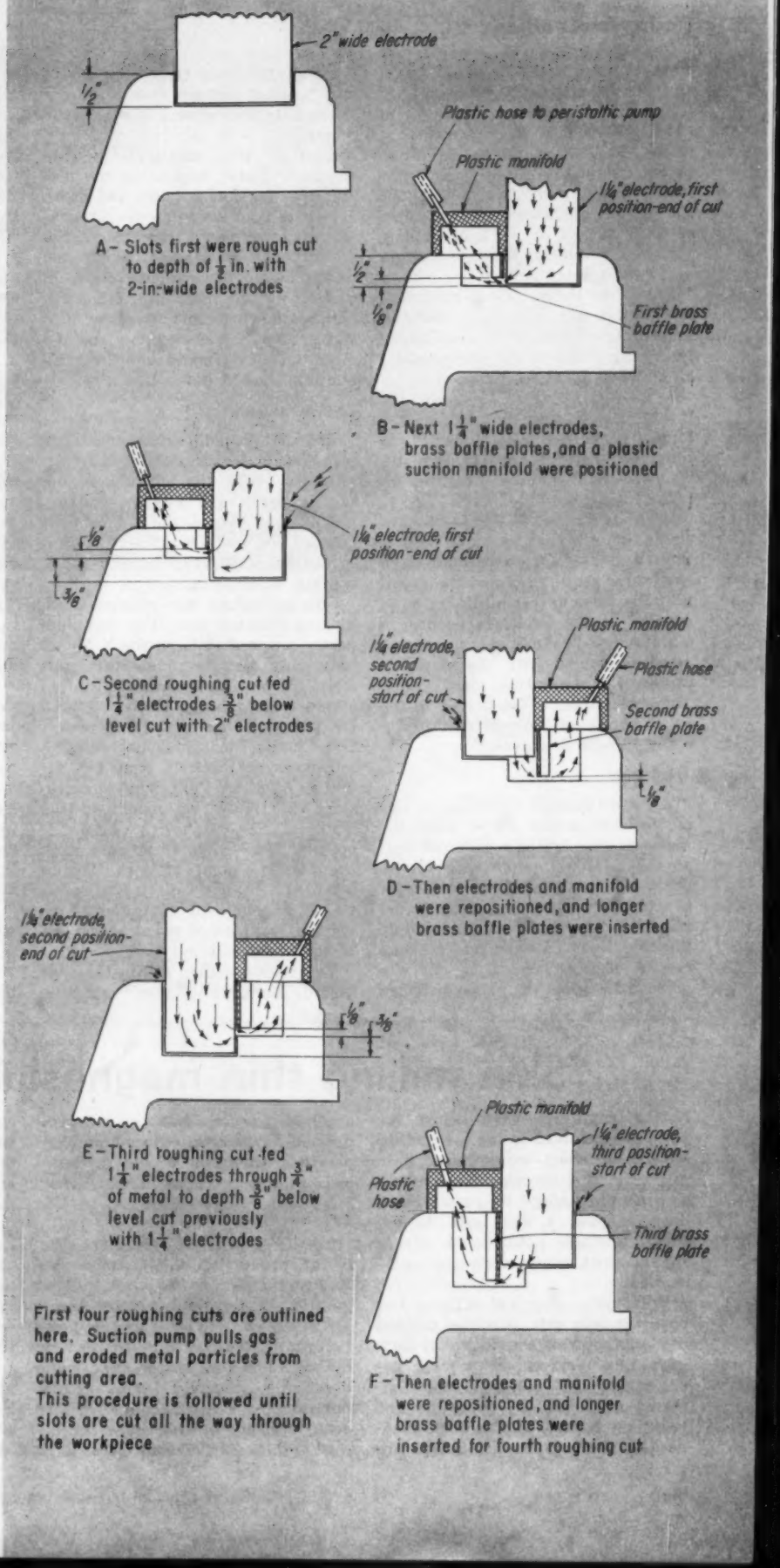
Under the original technique of sinking the slots horizontally, the rising gas is trapped, and the fluid coolant cannot displace it. Moreover, the transfer of heat from this hot gas (and the effect that it has on the electrodes) increases as slot depth increases.

Finishing cuts, for slots already roughed through the three workpieces, preferably are made horizontally, because horizontal setups are easier to locate precisely. Too, because slots have already been roughed through the workpieces, it is a simple matter to flow coolant through the slots during finish-machining.

Roughing the slots vertically eliminated long Lucite guide fixtures, which is the original setup maintained slot straightness when roughing from the solid in a horizontal direction. Thus electrodes could be shorter—3 to 4½ inches, instead of 7 inches long—and therefore cheaper.

Making electrode plates

As in the original setup, electrode plates (seven of them for each set


2" wide electrode
1/2"
A – Slots first were rough cut to depth of ½ in. with 2-in-wide electrodes
Plastic hose to peristaltic pump
Plastic manifold
1¼" electrode, first position-end of cut
1/2"
1/8"
First brass baffle plate
B – Next 1¼" wide electrodes, brass baffle plates, and a plastic suction manifold were positioned
1/8"
3/8"
1¼" electrode, first position-end of cut
C – Second roughing cut fed 1¼" electrodes ⅜" below level cut with 2" electrodes
Plastic manifold
1¼" electrode, second position-start of cut
Plastic hose
Second brass baffle plate
1/8"
D – Then electrodes and manifold were repositioned, and longer brass baffle plates were inserted
1¼" electrode, second position-end of cut
1/8"
3/8"
E – Third roughing cut fed 1¼" electrodes through ¾" of metal to depth ⅜" below level cut previously with 1¼" electrodes
First four roughing cuts are outlined here. Suction pump pulls gas and eroded metal particles from cutting area.
This procedure is followed until slots are cut all the way through the workpiece
Plastic manifold
1¼" electrode, third position-start of cut
Plastic hose
Third brass baffle plate
F – Then electrodes and manifold were repositioned, and longer brass baffle plates were inserted for fourth roughing cut

of slots) were of 65-35 yellow brass and Muntz metal (60-40 brass), in the form of annealed commercial sheet. When these sheets were rolled in the ANL shops, thickness had to be accurate within 0.0005 in. and flatness held within 0.002 in. throughout the entire electrode. To minimize warping caused by work hardening, thickness reduction during rerolling was held to less than 10%.

Rolled to the required thickness, the stock then had its edges sheared, and electrode plates were machined to the specified shape and dimensions. Then, clamped between heavy steel plates, they were heated to 575 F and held at that temperature for four hours before being cooled in the furnace. Finally, the electrode plates were sorted for flatness and accuracy; warped plates were either reworked or discarded.

For the new chopper rotor, we devised a simpler way to hold the seven electrodes required for each operation. Precision spacer blocks (ground parallel at the thickness needed to maintain electrode center distances) were assembled with the electrode plates in a clamp-type steel holder. Then we mounted the holder in the collet chuck on the end of the machine spindle (see photo).

Trial cuts

The most difficult EDM cuts, in any of the three rotor parts, were the four sets of roughing cuts in the wall of the K-Monel outer ring (10-in. OD, 6-in. ID). At first, we attempted to cut the full 2-in.-long slot by plunging 2-in.-wide electrodes into the ring. But this setup was not successful after the depth of cut was more than about ½ in., even when the dielectric fluid (transformer oil) was pumped through hose lines into the cutting area around the electrode plates.

Next we tried using 1¼-in.-wide electrode plates, oscillating the machine table slowly back and forth ¾ in. with the servo motor. The object here, of course, was to cut the 2-in.-long slots while feeding the electrodes down vertically. Here, on each side of the slots, the coolant was pumped down in seven streams. But this procedure was slow, because the metal particles could not be adequately washed out of the slots.

The final cuts

The final procedure combined, with refinements, features of the first two attempts. With the addition of the suction pump, and a series of brass baffles that helped the pump suck out gas and metal particles, we had a distinct improvement over the original EDM setup.

This procedure was so successful, in fact, that we used it to complete partly roughed slots on the K-Monel outer ring, also for rough-cutting all slots in the two natural-uranium core sections. Later, it was adapted for assisting the slot-sizing operations during horizontal machining.

The six sketches on page 143, together with the following description, show how we machined the slots:

First, 2-in.-wide electrodes sank the slots to a depth of ½ in. Then a set of 1¼-in.-wide electrodes, positioned on the end of the machine spindle, was located to cut at one end of the previously cut slots.

To provide baffles within the slots already sunk, we inserted brass shim stock (0.003 in. thick and ½ in. wide), folded longitudinally upon itself and then opened to about twice the slot width. To leave a space at the electrode cutting edges that would permit gas and metal particles to be sucked away, we made the brass shim ⅛ in. shorter than the slot depth.

A Lucite plastic manifold, machined to cover the ends of the seven slots, was connected by a plastic hose through a peristaltic-action pump to the machine's table tank.

In operation, the suction pump drew the coolant down around the electrodes, past the baffles, and into the manifold. This action efficiently drew gas and eroded metal particles from around the electrodes while they cut the slots deeper. With the new setup, we could sink the slots another ⅜ in., increasing stock removal by a factor of ten, before accumulated metal particles slowed the operation.

Next we reversed the assembly, inserted longer baffles, and cut the other ends of the slots deeper—⅜ in. more than at the end of the first cut.

We continued this procedure until slots were cut entirely through one side of the K-Monel ring. Then we repeated the process for the intermediate core and the center core, going all the way through the latter. Here all slots were rough-cut 0.010 in. undersize on width, before we changed setups for horizontally sizing the slots to required taper and dimensisons.

Suction-pumping for slot-roughing was so successful that we made up plastic manifolds that would permit using the same pump during final horizontal sizing work. •

Skin milling thin magnesium sheet

Boeing engineers have licked the problems involved in the mechanical milling of sheet magnesium. With magnetic tape (numerical control) and simple safety measures, they have adapted a skin mill to cut small, intricate patterns in missile engine strut skins safely and economically.

Previously, chemical milling had been the only safe, practical method of manufacturing the skins, but Boeing's new mechanical process has cut costs by $283 a missile and eliminated much of the explosion and radiation hazard of thoriated magnesium shavings or grindings. The automated process has also cut production times and reduced another previous drawback of the mechanical milling process: human error.

Halves set-up time

Missile engine strut skins are now in full production on the company's Kearney and Trecker skin mill at Seattle, Wash. The vacuum chuck allows 16 parts to be placed in position at one time, cutting set-up time in half. The two cutter heads, one describing a mirror image of the numerically controlled cutter, are cooled during milling by a spray-mist emulsion of oil and water. Machine operators are equipped with special shoe covers, respirators, and protective overalls; one operator keeps the cutting area clear of shavings with periodic blasts from an air hose. Samples of the air and dust around the mill have shown that the danger of radioactivity is negligible. Fire protection and fire fighting equipment is installed on or near the machine as an added safety measure.

With these precautions and the advantages of numerical control, Boeing feels that machine milling of thoriated magnesium now offers no special problems. •

NEW . . . and growing. Plants like the Shengyang No. 1 heavy machinery plant (above) produce lathes and many other basic machine tools

OLD . . . but still growing. People's Commune machine shop in Hopei Province is typical of many small shops throughout the mainland of Red China

Red China—a study in contrasts

By John Yamaguchi
AM/MM Tokyo Bureau

Is the Red Chinese metalworking industry as advanced as some of the machine tools that Peking "showcases" would indicate? Or is the industry better typified by the many backyard machine shops scattered throughout the country?

The wide disparity in quality of products and in the size of the plants that produce them is partly the result of one of the policies set forth for the government's second five-year plan (1958-1962). Mao Tse-tung, at the outset of the program, stressed the "co-existence" of large and small shops; the result has been the simultaneous development of large, relatively up-to-date plants, on one hand, and the continuing spread of small, backyard machine shops, on the other.

Other features of the plan included the transfer of 80% of some 880 plants from central government to local government control, and the establishment of seven "economic cooperation" districts.

Each of the seven districts, says the 1958 issue of the Peking Government's "The Machinery Industry," must have basic industry such as machine tool shops, power plants, heavy machinery shops, mining machine shops, motor and electric machine shops, chemical plants, farming machine shops, meter and ball bearing shops. In addition, each district must build general machinery shops housing 1000-ton hydraulic presses. And most of the plants and shops must be self-supporting, except for a partial supply of materials from neighboring districts.

These "must" projects apparently got the second five-year program rolling, because Peking Radio said late in 1958 that Red China depended upon foreign imports for 80% of its machinery in 1957, 40% in 1958, and would import only 20% in 1959.

Imports from Russia

Much of the machinery imported by Red China came, of course, from the Soviet Union. The 1956 and 1958 Trade Almanacs of the Soviet Union report that Red China imported 2.99-million rubles worth of machinery from USSR in 1955, 2.93-million rubles worth in 1956, 2.18-million rubles worth in 1957, and 2.54-million rubles worth in 1958.

Japanese observers say that the Red Chinese would have imported more Russian machinery had it not been for the Peking Government's payments problem and the high price and poor quality of the Russian machinery.

"The Machinery Industry" went even further, predicting that Red China would be self-supporting to the extent of 90-95% in machine tools, 86% in cast-iron machinery, 80% in wrought-iron machinery, 95% in gages, and 100% in grinding materials by 1962.

How these predictions are turning out is still unknown. Peking Radio has been strangely silent on the state of industry since the beginning of 1960.

1962 goals

The National Economic Planning Committee set aside 70% of the total 1959 capital investment of $5.2 billion for the machinery industry. It set 1962 targets for machine tool production of 60,000 to 65,000 units. Other 1962 targets include 30,000 to 40,000 tons of mining equipment; 1.4- to 1.5-million-kilowatt power plants; 100,000 to 120,000 tons of aluminum ingot; 1.05- to 1.2-million tons of steel ingot (already said to have been surpassed in 1959); 5- to 6-million tons of petroleum; and 19- to 21-million tons of coal. •

Field repair slashes downtime

First aid for a giant bearing

By Dana A Regillo,
Lincoln Laboratory,
Massachusetts Institute of Technology,
Lexington 73, Mass

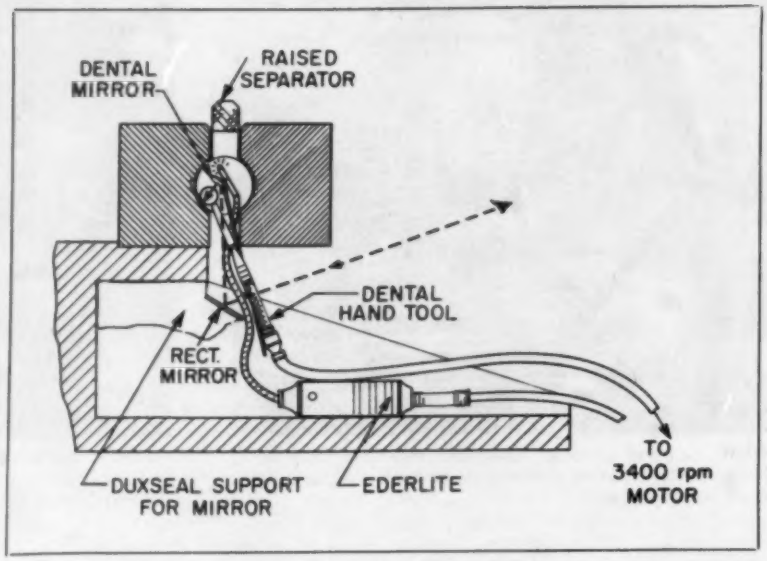
Traditionally, major repair of the 10- to 13-foot-diameter bearings used in large antenna systems has involved complete bearing removal and disassembly. Bearing removal and reinstallation have often been so extensive and so intricate that the antenna has been put out of operation anywhere from four to ten weeks.

But now, engineers at MIT's Lincoln Laboratory have twice succeeded in overhauling a 10-foot-diameter, four-point-contact bearing, fully assembled in its housing, with a downtime of only 10 to 12 hours.

The bearing contains 92 two-inch-diameter balls on a 115-inch ball pitch diameter—with 23 ball separators. The races are 8660 steel, the ball material 52100 steel. Total bearing weight: 2600 pounds.

An accuracy of 0.006 inches in both roundness and flatness must be held during installation. This single bearing takes all operational loads for a 120-foot-long, 20-foot-high rectangular reflector, which rotates outdoors at up to 5 rpm.

In this particular bearing, the balls clicked audibly after many hundreds of hours of operation. Engineers inspected the fixed outer race by feeling it with their fingers, found a large damage spot on the lower path.



Repair procedure on outer bearing race

Analyze damage

Damage was further inspected with a special (90° periscope) borescope and a miniature probe-extension light. Weekly photos taken through the borescope over a 30-day period showed slight, but positive, retrogression. Because the borescope field was smaller than the damaged area, a mosaic of about seven photos was assembled to show the damage.

Most critical damage: A deep vertical "cliff," which showed progressive decay as loaded balls repeatedly traversed from the smooth raceway to the mottled area. A plaster cast of the damage was made from a beeswax impression, for thorough study.

Bearing repair called for eliminating the cliff, tapering the undamaged ball path leading to it, and grinding out the entire damaged area. Extensive downtime could not be tolerated, so the job had to be done without disassembling the bearing.

To prepare the bearing for the operation, the inner race was rotated until the separator-ball configuration provided maximum space between a ball and separator leg at the damaged area.

The reflector structure above the damaged area was jacked up just enough to relieve the load on the five balls in the separator. Then the two retaining crossbars on the separator were removed, allowing the separator to be raised ⅛ inch. This arrangement gave the machinists about four square inches to work in—somewhat similar to that in surgery.

The entire area was thoroughly cleaned and degreased, then was completely sealed off from the rest of the bearing. This was done by first covering the surrounding area with Tac-cloth, and then with Duxseal, a pliable putty-like sealant, which absorbed the machining grit.

Dual mirrors (a small rectangular mirror and a dental mirror) permitted the machinists to see what they were doing. Light was provided by an Eder-lite, a miniature probe-extension lamp previously used in photographing the damage.

Corrective machining involved getting the balls into a "no load" condition. This was done by smoothing out the rough area, and by tapering its leading and trailing portion, so as to allow the balls to enter and leave the area with a gradual load transition.

Simple tools

Machining was done with an SS White No. 725 FlexArm and a No. 7 dental hand piece driving an 0.5-inch-diameter polishing sphere at 3400 rpm. Before working on the bearing, the machinists practiced on samples of 8660 steel.

Because of cramped quarters and frequent pauses for cleaning away the grit which covered the light, mirrors and work area, the job was arduous and time-consuming. The machinists worked in 20 min. shifts.

With the work area thoroughly cleaned, the separator reassembled, and the antenna load applied, a random ball placed over the center of the repaired area could be freely moved ⅝ inch—the desired "no load" condition. Tests at 5 rpm and wind speeds of 25 to 30 mph showed satisfactory operation.

Several months later, the inner race was repaired in the same way. Since then (and that was thousands of operation hours ago) the bearing has been trouble-free. •

Sub Surface to Outer Space

Under or on the surface of the earth, in the air or in outer space, screw threads are vital to man's ability to live, move or work. Strip his inventions of screw threads and he would return to a village handicraft existence. Yes, it would be hard to overstate the importance of screw threads in our modern world, and equally hard to imagine generating internal screw threads efficiently without taps. If you use either standard or specially designed taps for products on which men's very lives depend, can you afford to use any but the best?

USE TAPS WITH CONFIDENCE, USE GREENFIELD TAPS **GREENFIELD TAP & DIE** GREENFIELD, MASS.

Why Kearney & Trecker chose 8-channel punched paper tape input

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One major key to Milwaukee-Matic efficiency is the input. Kearney & Trecker picked 8-channel punched tape for reliability, durability, accuracy. And one thing more: ease of preparation on the Friden Flexowriter®. The Flexowriter has a standard typewriter keyboard. The operator (any competent typist) prepares a *visual* proof as she makes the tape. The machine parity-checks each code automatically. And finished tapes can be double-checked (or quickly duplicated) by running them back through the Flexowriter's reader.

Along with Kearney & Trecker, the great majority of machine tool manufacturers have already standardized on 8-channel punched tape input. Take it from them: punched tape is the best NC input. And in punched tape, Friden is the leader.

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Friden

Sales, Service and Instruction Throughout the U. S. and World

Laminated Plastics and Fiber—IV

By John T Bishop, production manager, Continental-Diamond Fibre Corp, Newark, Del

As shown in Parts I, II, and III, conventional equipment and methods are satisfactory for most machining operations on laminated plastics and fiber. The same can be said for cutoff, grinding and forming operations. Practical tips are:

Sawing

Nothing does a better sawing job on either laminated or vulcanized products (where tolerances are not critical) than a standard woodworking bandsaw with 5 to 8 points per inch, operating at speeds up to 9000 fpm. The bandsaw should always be used for curved cuts and for straight cuts on thick materials (up to 10 in. thick).

Use a circular saw for cutting thin material. For close tolerances and smooth, straight edges, the saw should be 1/16 to ⅛ in. thick and hollow-ground without set. The saw should have 4 to 8 teeth per inch.

Glass-Base Laminates

If over ⅛-in. thick, such laminates should be circular-sawn only. Carbide-tipped blades are preferred, but bonded-abrasive cut-off wheels or diamond cut-off wheels also do a good job. Air jets or liquid coolants should always be used with this equipment. A bandsaw with a skip tooth is normally used for irregular cutting of glass-base materials.

A health problem can sometimes be created by the sawing of glass-base laminates. If any volume of this work is done, an adequate dust-collecting system is recommended.

Sanding

Both laminates and vulcanized materials can be sanded with standard woodworking or metalworking equipment at speeds to 2000 fpm. Sanding is performed either dry or wet. Surface sanding is done on a drum-type machine using abrasive papers, the grit ranging from 40-240. Speeds up to 2000 fpm are used. Very close tolerances can be obtained with such equipment.

Wet grinding keeps the work surface free of imbedded grit and prevents the resin from softening and loading the abrasive wheel or disk.

Centerless grinding is done at speeds of about 900 sfpm with silicon-carbide wheels.

Punching, Drawing, Forming

Both cold and hot punching techniques are employed, depending on the nature of the laminate. Standard punch presses are used with progressive, compound or other suitable dies. Clearances between punch and die are much less than those used in punching metal. When working to close tolerances, cold punching is preferable because of the thermal contraction which occurs when the heated laminate cools. For hot punching a temperature of 120 F for 30 sec usually provides the necessary pliability, although some laminates require softening temperatures as high as 300 F.

If hot work is to be done, proper shrinkage allowances must be made. For instance, a piercing punch for 1/16-in. material should be 0.002-in. oversize.

Some laminates have thermoplastic properties which permit them to be drawn and formed, or "postformed", by heating and

Bandsaw Practice for Laminated Plastics and Fiber
Saw Speed: 4000-5000 fpm

Type of Part	Width In.	Thickness In.	Points Per In.
Irregular	¼—⅜	0.037	6*
Disks up to 5 in.	¼—⅜	0.037	6*
Disks over 5 in.	½	0.037	5
Strips and Blocks	1¼—1½	0.042	5

* Skip tooth

Circular-Saw Practice for Laminated Plastic and Fiber
Saw Speed: 3000-3600 rpm

Material		Saw Specifications		
Type	Thickness	Thickness	Teeth Per In.	Type
Sheets:				
(Paper & Fabric)	1/16	1/16	6	Carbide or HSS
"	⅛	3/32	6	"
Glass	1/16	1/16	6	Diamond wheels or Carbide
"	⅛	3/32	4	"
Over ¼ in.		⅛	4	Carbide
Tube	under 1 in.	1/16	5	Carbide or HSS
Tube	over 1 in.	3/32	5	"

HOB TWO FOR THE PRICE OF ONE

By switching to a lead-treated steel, Thor Power Tool Company cut the cost of these idler gears in half. Aristoloy 4620 (leaded*) provided high strength with excellent wear and shock resistance qualities. On gear cutting operations, machinability jumped from 35% to 66% (of B 1112). And there was a marked improvement in surface finish.

If you would like to know more about the production economies of lead-treated steels possible on hobbing, broaching, milling, and particularly automatic machining operations, write today for LEADED STEELS CATALOG. Or call your nearest Copperweld representative.

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Laminated Plastics and Fiber—V

then placing in a cold mold while the heated resin cools. Forming molds can be made from almost any material (hardwood, plastics, aluminum, steel, etc.). Various heat sources are used, including infra-red lamps, electric ovens, and immersion in hot baths. Either hydraulic or pneumatic presses may be used.

Vulcanized fiber is permanently formable with proper application of moisture, heat and pressure. The fibers of the material "flow" when all three of these agents are applied, then take a permanent set as the heat and pressure "cook" out the moisture.

Shearing

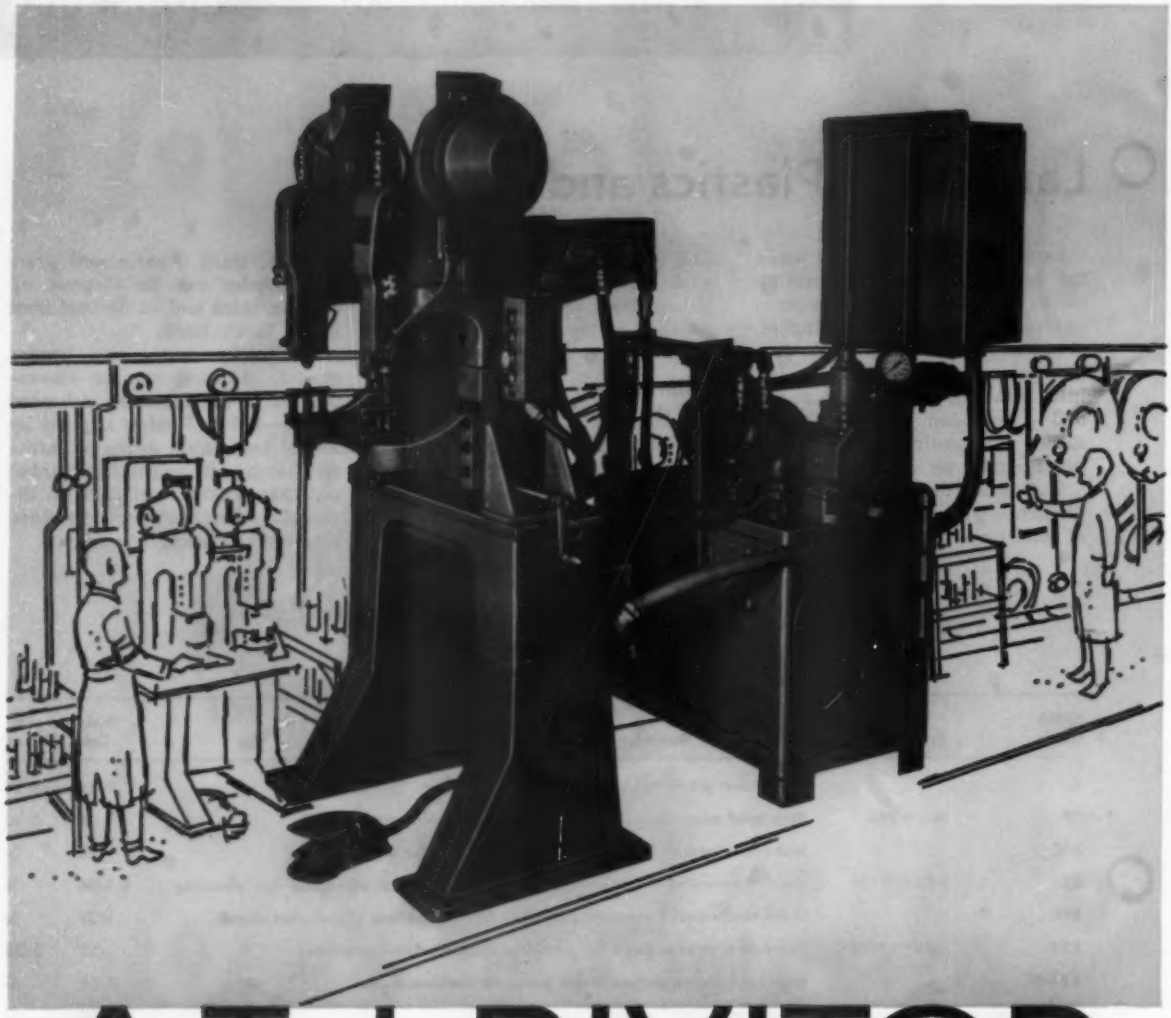
Laminated plastics or vulcanized fiber are cut to size on standard guillotine-type, metal-squaring shears or by using a rotary shear. This method is suitable for most paper-base grades up to 1/16 in. thick. Fabric and glass base grades can be sheared up to ⅛ in. thick and vulcanized fiber up to ¼ in. thick.

On thicker items and harder grades, shearing can be accomplished if the material is heated to 200—250 F. Heat is applied by use of hot plates, ovens or infra-red lamps It might be pointed out that greater variations in dimensional stability are obtained when hot shearing is used. •

Maximum Thickness of Laminated Plastics and Fiber for Cold and Hot Punching

NEMA Grade	MIL Specification	Remarks	Thickness, In. Cold	Hot
X		Lowest cost grade. Fair punching quality	1/16	3/32
XP	MIL-P-78A	Very good punching qualities. Hot punch for intricate parts	1/16	3/16
XPC		Best paper base punching qualities. Warm punch for intricate parts	⅛	¼
XX	MIL-P-3115B	Good mechanical & electrical properties for general use—good hot punching	3/64	⅛
XXP		Good mechanical & electrical properties. Use for intricate shapes—hot punch	1/32	⅛
XXX	MIL-P-3115D	Poorest paper base grade for punching. Good electrical properties	1/32	3/32
XXX-PC	"	High electrical properties. Warm punch for intricate shapes	1/16	⅛
XXXP	"	Good hot punching quality	1/32	⅛
C	MIL-P-15035B	Medium-weave fabric base. Good punching qualities	1/16	¼
CE	"	Medium-weave fabric base. Good hot punching	1/16	3/16
CF	MIL-P-8655A	Postforming grade. Excellent punching quality	1/16	¼
L	MIL-P-15035B	Fine-weave cotton-fabric grade. Best fabric grade for punching	1/16	3/16
LE	"	Good hot punching fabric grade	1/16	3/16
MC		Melamine fabric grade. Poor punching quality	—	1/16
A	MIL-P-8059A	Asbestos paper base. Poor punching quality	1/32	3/32
AA	"	Asbestos fabric base. Fair punching quality—rough edges	1/16	⅛
G-3		Glass fabric—phenolic grade. Good heat resistance & good electrical properties. Difficult to punch	1/16	⅛
G-5	MIL-P-15037B	Glass fabric—Melamine grade. Fair punching quality	1/16	3/16
G-6	MIL-P-997B	Fair punching quality	1/16	⅛
G-7	"	Glass fabric—silicone grade. Fair punching quality	1/16	⅛
G-10	MIL-P-18177B	Glass fabric—epoxy grade. General-purpose. Good punching quality	1/16	3/16
G-11	"	Flame-retardant grade. Good punching quality	1/16	⅛
N-1	MIL-P-15047B	Good punching quality	1/16	3/16
GPO-1		Fair punching quality—abrasive on dies	1/16	⅛

1. Cold punching refers to room temperature of 75°F—100°F.
2. Hot punching refers to range of 225°F.—300°F.
3. Warm punching refers to range of 130°F.—175°F.
4. All glass fabric grades are abrasive and cause fast tool wear.



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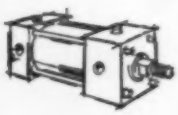


CYLINDERS

CUTTING TOOLS

T-J TOMKINS-JOHNSON
JACKSON, MICHIGAN

Talking Shop

Best Year

THE LOWEST unemployment in the U S was in 1906. That year only 0.8% of the civilian labor force was jobless. That is also the only year in this century that the figure has been under 1%. But in that year, average hourly pay of factory workers was under 19¢.

The worst unemployment was in 1931 to 1940 when it ranged between 14 and 24% of the labor force. All these facts come from a new book, *Historical Statistics of the United States, Colonial Times to 1957.* You can get it from the Supt of Documents, U S Printing Office, Washington 25, D C, and it will cost you $6.

One depressing statistic is that in 1900, 56% of the enrolled students in public schools took algebra. In 1949, it was 26.8%. In 1890, 22.8% studied physics; by 1949 this had dropped to 5.4%. Having just finished reviewing the article on magnetic forming principles, we rather wish we had studied more of both subjects. It looks like we'll need it to keep up with metalworking.

Off Base

A READER slaps our wrist for stating in a recent Spot News item that a gear cutting machine holds a tolerance of "0.000,001 mm". We deserve the slap because we didn't intend to publish that claim unless the developer (a Czech firm) could prove it to us. We think the firm might find difficulty in locating gear-inspection equipment capable of proving it to us, and by breathing hard on the gear we could probably throw it out of tolerance. The gear-cutting machine has some unusual features and we felt it was worth reporting, but somebody got carried away in reporting that claim, and it was a moment of aberration that let it get into print.

We are firm believers in caution in reporting tolerances and we apologize to all readers who respect millionths of inches (and millionths of millimeters are even worse) and also to any who didn't know enough to doubt us.

Oxide Tools

HERE'S a recent application report on ceramic tools: Gear blanks of cast iron are being bored on the inside and turned on the outside in one operation with oxide insert tools on a 42-in. vertical turret lathe. The blanks are 40 in. OD, 7 in. wide, alloyed cast iron and have been rough machined.

For the finish operation the speed is 760 rpm, for a 800 sfm speed, feed is 0.062 ipr, and depth of cut is 0.015 in. The Carboloy 0-30 inserts are 1½-in. buttons, ⅜ in. thick, and are said to machine five blanks per index, and 200 blanks per insert.

The previous tools were said to average one blank per index, and were presumably carbide.

Safety Glass Flap

NOT TOO LONG AGO the sales talks for cars carried on quite a dispute about safety glass. Now comes a statement from the Automobile Manufacturers Assn that should put an end to the argument.

Both tempered glass and laminated glass meet the requirements of the American Standards Assn safety code for side and rear windows. The only reason that tempered glass is not favored for windshields in the U S is that if it fractures and remains intact it becomes opaque.

Cornell's crash injury research indicates a *slight* safety advantage for tempered glass in side windows. And tempered glass stands door-slamming abuse somewhat better.

So the next car salesman we talk with will please refrain from telling us how much better whichever kind of safety glass he has is.

Colvin Reports

THE COMMENTS in this column recently about two long time readers —and about Fred Colvin, who is a longer time reader we didn't count because he is our Editor Emeritus— brought a letter from Fred, who was recently in an auto accident. Those who know Fred will be interested in some excerpts:

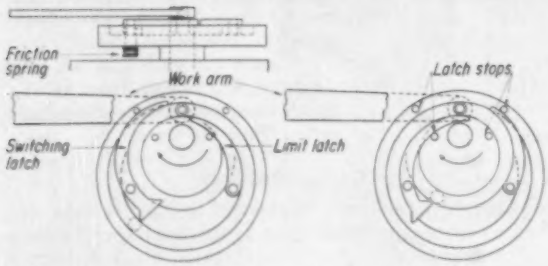
"I was much interested in your comments, having more time than usual to read because of a busted leg. I met Zonas Candee years ago in the Gleason shop in Rochester and I remember his articles on gearing."

We had said that Fred probably looked at the wood-cut illustrations in the first issue of *AM*. Fred says "My father began advertising in the AMERICAN MACHINIST before it was six months old. So your remarks about wood-cut illustrations hit the nail on the head . . . My first visit to the office was in 1891 or 1892. It was then on the second floor at 96 Fulton St.

"Now, at 93, I am waiting for a broken leg to get back to normal so I can again hit the road to keep in touch with new shop developments in machine practice. I had hoped to fly to Europe again this year but may have to wait for 1962." •

Practical Ideas

Two-Track Eccentric Oscillates Work Arm in Alternate Cycles



The two-track eccentric can simplify your production line by actuating a single work arm for two different operations or for two variations of the same operation. We used this eccentric to alternately space wire strands at different center distances.

As the roller slide passes through the small diameter track, the work arm performs one function. When the roller traverses the large track, a different operation is completed. But, regardless of the position of the roller, no timing mechanism is required to guide it into the alternate track because the roller will trip itself into the next cycle only after it has entered one cycle. As the slide enters either track it trips the switching latch by bumping against the switching latch protrusion. As the slide leaves one track it forces open the limit latch, and enters the next cycle by passing on the alternate side of the switching latch.

Although both switching latch and limit latch act as track extensions for the inner and outer edges of both tracks, only the switching latch must be kept in the tripped position. So, a light compression spring, slipped over the pivot pin on the underside, is used to hold the switching latch open.

L Kasper, Philadelphia, Pa

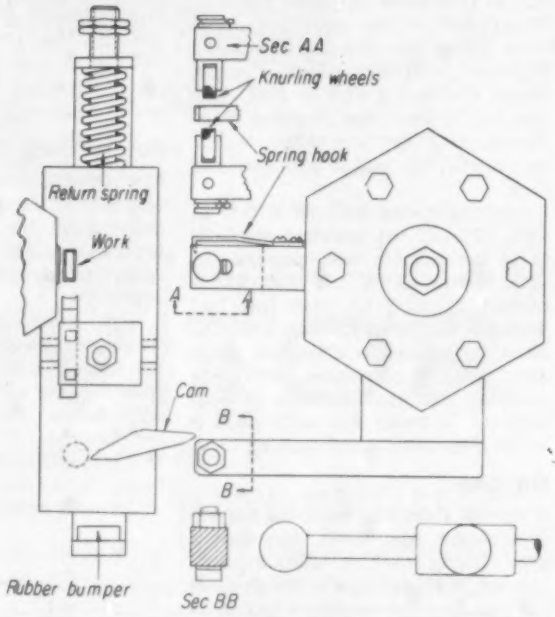
Turret-Lathe Modification Speeds Production

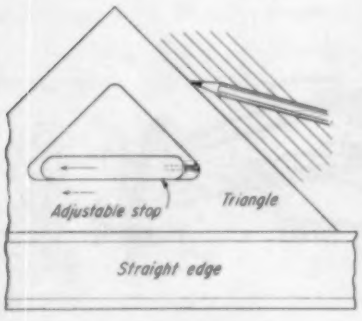
One motion, forward with the longitudinal-feed handle, is all that is necessary to turn, chamfer, and knurl the periphery of a brass knob. This is all made possible with a small modification of the cross slide on a turret lathe and knurling tool in the turret.

The modification consists of first disengaging the cross-feed screw and removing the handle, then adding a spring in back of the slide and a rubber bumper at the front. A cam is affixed to the top of the slide which, with the help of an arm-mounted roller, activates the slide. Once the depth of the slide motion has been established, a forming tool is adjusted to produce the correct diameter and chamfers.

Next, a yoke, carrying knurling wheels in adjustable holders, is mounted vertically in the turret to avoid interference with the cutting tool. The yoke also carries a spring hook which catches the knob on the completion of the cycle to pull the work out of the opened collet. A 37% increase in production is the result of this touch of automation.

Ivar Ost, Brooklyn, NY





Drafting Trick Saves Time

Instead of guessing the distances between parallel crosshatch lines, you can draw to exactly even spaces with this device. It's a plastic strip with a machine screw threaded into one end.

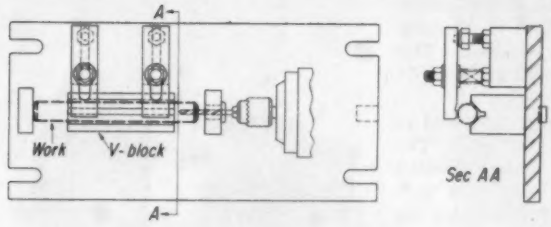
Place your triangle on the straight edge, and set the plastic strip inside the opening so that it rests firmly against the (inside) bottom edge and the angle to the right. Draw the first line, hold the triangle firm and slide the strip along the triangle until it stops at the angle on the left. Then slide the triangle left until it's stopped by the screw, and draw the second line. Again slide the strip, then the triangle, and draw, etc.

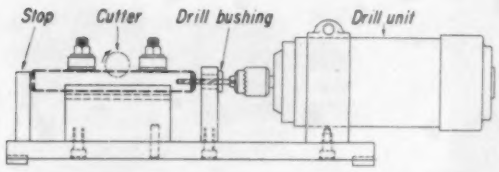
By drawing the line with the strip braced against the right side, you lessen the possibility of accidentally moving the triangle (as you might, if the strip were braced to the left while drawing).

The adjustment screw allows for different set distances between lines.

Christian A Nielsen, Madison, Wis

One Step of Work Cycle Free in Automated Setup





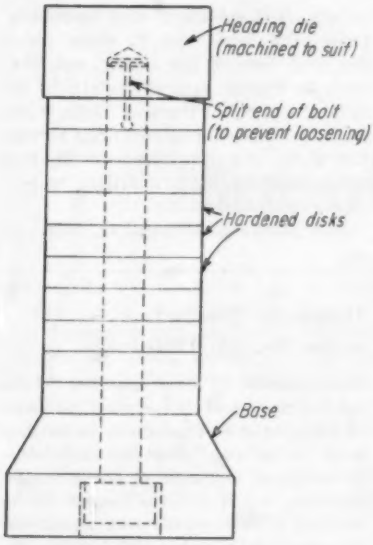
Designed to obtain a small hole in the end of a shaft without expending time on a separate operation, this fixture employs a self-contained drill unit to operate during the milling of a key seat. It is energized by a switch automatically triggered when the table is raised to feed the work into a Woodruff-key cutter. The parts being machined are idler shafts made in large quantities in the manufacture of gasoline engines.

Basically, the fixture is built on a mild-steel base with two locating keys and four slots for bolting it to the machine table. A V-block screwed and doweled to the base serves as work nest, and two strap clamps secure the work on either side of the cutter.

At one end of the V-block is a stop block against which the work rests. And, at the other end stands another block, away from the work, carrying a standard drill bushing. The drill unit (a No. 20-012 Dumore) is mounted in a split clamp secured to the base at a distance governed by the spindle travel. When the drill reaches full depth, the chuck stops just short of the drill bushing.

While this fixture was made for a specific part, it can readily be seen that applications of this kind are practically limitless.

Roger Isetts, Kenosha, Wis



Stacked Disks Made Strong Heading Post

A series of steel disks, individually hardened, assembled, and held together with a tie bolt, proved to stand up better as a heading post than one made of solid steel.

This solved a serious problem in heading 155mm brass casings which were to be produced in several 2800-ton hydraulic presses. Heading posts made of a good grade of alloy steel were heat treated and tried; but, because of the large diameter (6.102 in.), penetration was impossible. The soft centers would give way to the pressure, causing the posts to swell and shorten.

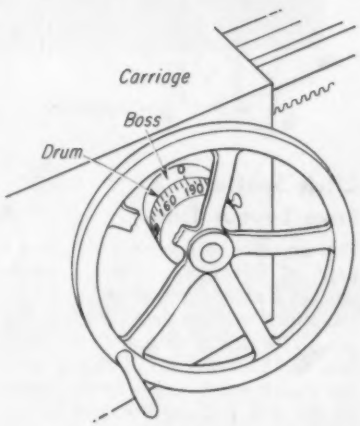
Better hardening penetration was therefore the only answer. The one way I could see this done was by assembling the 34-in. long posts in sections—each being thoroughly hardened to reduce, if not eliminate, compression. Consequently, the portion between the mounting base and the heading die at the top was made up of disks, approximately 1½ in. thick, which were ground parallel after heat treating.

The presses used were of the three point tie-rod design with circular bolsters. In all cases, one of the tie rods served as the fulcrum of the bolster which was hydraulically indexed and interlocked with the stroke of the press. This permitted a three-station setup — loading, heading, and unloading.

George F Oliver, Richfield Springs, NY

Micrometric Carriage Control Speeds Production

Since adapting a micrometer drum to the carriage crank of our lathe I have saved time while maintaining accuracy in turning and boring depths. True, the idea isn't new, inasmuch as both the crossfeed and compound feed on all lathes are so equipped. But, to my knowledge, the value of an indicator for longitudinal travel has been overlooked by the tool manufacturers.



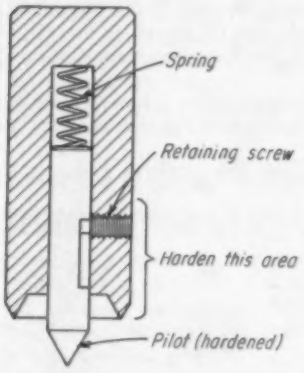
Feeling a need for this feature, primarily to eliminate the use of stops and gage blocks, I machined a boss to be secured on the lathe apron and a drum to slip over the crank spindle. Having marked the top edge of the boss with a zero and a witness mark, the entire periphery of the drum was graduated in relation to the movement of the carriage.

This was done by clamping a large-capacity dial indicator to the bed and feeding the carriage against it. Each

movement of 0.001 in. was then marked with pencil on the drum and later engraved and stamped. A wing screw was provided to lock the drum on the spindle.

Don't expect, however, that the graduations will come out evenly, like 0.100 or 0.200 in. per revolution, as is the case with feed-screw calibrations. But, as long as the gears and rack are in good condition, the movement readings will be quite reliable all along the bed.

Enrico Marchesi, Buenos Aires, Argentina



Circle Spotters Save Layout Time

The cautious mechanic will, using a pair of dividers, scribe a circle around a carefully laid out and center-punch marked hole location. The reason for this is, obviously, to maintain and preserve that location after the punch mark has been destroyed by the drill starting the hole—a fact well known to all conscientious operators.

It is also well known that, though simple, this process takes time when a number of such locations have to be spotted. Wouldn't it, then, be easier to get the same result with a light blow of a hammer? I thought so, and went about making a set of circle spotters like the one shown in the sketch.

For each circle diameter required, a spotter is made with an OD of from ⅛ to ¼ in. larger than the circle it is to make. One end is then recess bored at 30° to the diameter of the circle wanted, and the OD is beveled, also at 30°, to meet the bore. Concentric with the edge thus produced, a hole is drilled and bored deep enough to take a spring and a pilot pin. This pin can be a standard ¼-in. dowel ground to a concentric 60° point and with a flat on the side to accept a retaining screw. The business end of the spotter is hardened and drawn.

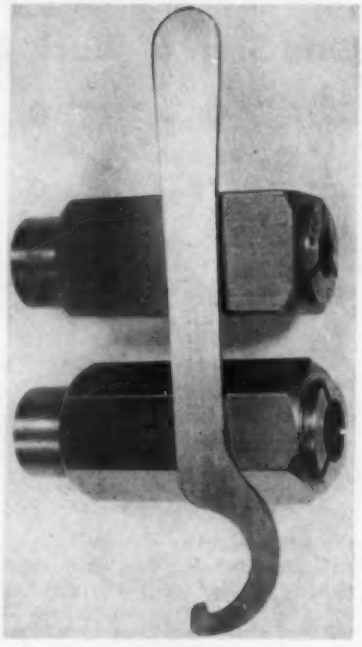
In use, the pilot point is placed in the punch mark on the work. The body of the spotter is then pressed down in contact with the work surface and given a light to medium tap depending on the size of the tool. Each spotter is stamped with the size of circle it inscribes.

Gerald Millerwise, Sebewaing, Mich

Collet Blocks Simplifies Many Shop Jobs

These collet blocks are invaluable in the tool room for milling, grinding, inspection, and bench work. They can be clamped in a milling vise, strapped to the table, or held on a magnetic chuck while gripping work to be indexed during milling or grinding. A bench hand will also find them handy for holding round work in a bench vise while hand working the piece.

A set made up of two blocks, a square and a hexagonal, provides indexing to 2, 3, 4 and 6 positions. Each is bored precisely through its center to accept standard, available



collets. And on each, both ends are faced; the front end to show only the oval face of the collet, and the back to expose approximately 75 to 80% of the collet threads. Nuts, with OD's less than the dimensions across the flats, are machined to fit the threads, and holes are drilled to accept a spanner wrench.

Ray Shoberg, Milwaukee, Wis

Federico Strasser
Santiago, Chile
Won $25 for his idea:

Throwout Clears Die
in the Dec. 26, 1960 issue

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HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

John Dykstra

The all-steel closed auto body, one-piece fenders, die-building without power hammering, extruded front-axle spindles, air clutches for punchpresses, cushion beds for presses—these are just a few of the milestones in the half-century rise of this Dutch-born onetime apprentice to one of the nation's top automotive posts—Ford Motor Co's . . .

Manufacturing VP

It's quite a climb from a 5¢-an-hour sheet metalworking apprentice to vice president manufacturing of Ford Motor Co, about as lofty a post as there is in Metalworking. It has taken John Dykstra, who started at 14 with the old Briscoe Car Works, just short of half a century to do it.

Actually, John Dykstra was born into the trade—the son of a Dutch master coppersmith. When the family immigrated to Detroit in 1912, the older Dykstra found work handcrafting prototype automobiles.

It was only natural that his son choose an apprenticeship under such an outstanding craftsman as Otto Groehn, and that he have his journeyman's papers by the time his schoolmates were headed for college.

Dykstra's transition from the shop to a plush, picture-windowed office a few doors down the hall from Henry Ford II has produced many a lasting change in automotive production methods.

In fact, Ford's acknowledged leadership in the efficient use of plant and automation is in significant measure due to Dykstra's accumulated experience. This was first put to use in 1947 under the direction of one of the greatest of them all, Del S Harder, at a time when young Henry Ford was beginning his famed clean sweepdown, fore and aft.

Troubleshooter

At that time, the affairs of Ford were a tangled mess—a fact which Ford was the first to acknowledge. Plants and product were obsolete, employee morale at the supervisory level was non-existent, and—most important—there was no system of cost accounting. (It later turned out that the company had been losing $9 million a month during these early postwar years.)

In the 10 years that followed, Harder and Dykstra supervised the direction and tooling of 24 major new Ford manufacturing plants. Scope included setting up one of the world's largest foundries, converting an old Model T plant in Highland Park to truck and tractor production, and building a tank plant and jet engine plant.

Today, Dykstra manages to take such truly large jobs in his stride, cramming them into a 45-hour workweek with only an occasional briefcase of leftovers to take home.

It wasn't always that way. As an apprentice, his hours were 6 am to 6 pm, six days a week. But Dykstra evidently thrived on them—by the time he was 28 he was manager of all stamping operations for Hudson Motor Car Co.

Hudson, then rapidly expanding but also plagued with a lack of manufacturing know-how, bought out Clayton-Lambert Mfg Co for its organization and talent, and Dykstra came with the package. Hudson made a good deal—so good in fact that Cadillac a few years ago purchased and renovated this same old plant for its stamping operations, in

preference to building a new one.

Hudson was once known for its engineering innovations in metalworking, and this reputation was primarily due to Dykstra. Although it is not generally known, Hudson pioneered the all-steel closed body, and it was the first to make a one-piece fender.

In his early years at Hudson, Dykstra initiated and developed air clutches for punchpresses, coming up with a design so practical that it is still in use. He also generated development of the Marquette cushion bed for presses, banishing forever the converted railroad car springs then in use in industry.

Dykstra "firsts"

Credit Dykstra, too, with air counterbalance springs for presses and for being the first to install the big, and then untried, Taylor-Winfield buttwelders. Another Hudson first: paper disk grinding.

But Dykstra's own choice of the biggest "first" of all was the gradual improvement of die-building techniques to the point where power hammering could be completely eliminated. Power hammer men, Dykstra recalls, "were all Danes, except for me, and they made $40 a day in the late Twenties."

During the depression, Hudson, at one time the industry's third largest builder, fell on evil days. Even so, Dykstra and his men managed to tool the all-new Terraplane in about three months, and at a cost of only $8 million. Today, a similar job would take 12 months and $80 million. Unfortunately, the Terraplane was a flop, mainly because of its splash lubrication of a high-speed engine.

Dykstra stuck it out with Hudson until a new VP manufacturing came in who insisted on doing all of the hiring. In 1934 he quit and began his 13-year association with Oldsmobile. By 1941, he was Old's manufacturing manager.

In the Thirties, Olds was known as GM stylist Harley Earl's experimental car, and as such had more than its share of complex curvatures. Dykstra was the first man in the organization able to stamp out one of Earl's tricky fenders in one piece.

Keeping up with Earl's imagination led to the origination of cold-formed bumpers—simply because the 1939 model called for a shape impossible to form hot from spring steel without an extreme refinishing penalty. Dykstra cold-formed the design from NAX high-tensile steel, found that no supplier was set up to do the job, and so Olds went into the bumper business.

Dykstra joined Ford in the early postwar years, and soon on Dykstra's initiative, Ford switched (in 1949) from forged to extruded front-axle spindles. Result: superior grain flow.

Today, Dykstra is especially proud of Ford's Sterling Township axle and front suspension plant, which he claims is the most modern in the industry. It can heat treat 65,000 gears a day, and at the same time turn out 20,000 axle shafts and spindles.

It is an outstanding example of Dykstra's basic philosophy: "Make rather than buy wherever you can." This way, he says, you can control design, manufacturing, and in-process components.

Spartan regimen

All his life, Dykstra has set a strict regimen for himself. He has never played a game of golf, has no basement workshop. His top hobby: technical reading "to keep up with new machine tool developments." One football and two baseball games a year is his self-imposed limit on spectator sports. For vacations he keeps a small fishing boat in Florida.

At 62 a six-time grandfather, John Dykstra has three years to go before mandatory retirement. Maybe then he can get in those extra ball games and some full-time fishing. But Dykstra at the moment is three full years away from retirement and contemplation of a full rewarding life, and if lifetime performance is any criterion, those years will be chock-full of Dykstra-inspired innovations that will have a lasting effect on automotive industry production. •

Bendix Corp has named **Roy R Winn** Great Lakes regional manager for the Bendix Industrial Controls Section. Mr Winn has been transferred from the Sheffield Corp, a Bendix subsidiary, to service the builders and users of numerically controlled machine tools in the new territory.

Nylok Corp, Paramus, NJ, manufacturer of self-locking threaded fasteners, has appointed **J Algot Johnson** vice president, research and engineering. He replaces **J E Johnson** who is now president of Aerospace Nylok Corp, a newly formed Nylok licensee.

Yale & Towne Manufacturing Co has appointed **Walter R Saunders** north midwest regional manager of the Yale Materials Handling Division.

General Electric Co has appointed **Joseph C Mogavero** manager, metal production operations, of Metallurgical Products Department, Detroit. He was previously manager, maintenance and utilities, Silicone Products Department, Waterford, NY.

Amperex Electronic Corp, Long Island, NY, subsidiary of North American Philips Co, has appointed **Jan Bleeksma** vice president in charge of manufacturing. He was previously plant manager.

Pratt & Whitney Co, West Hartford, Conn, has named **Mayo S Silvey** contract sales manager. He was formerly associated with Alco Products Inc, Schenectady, as assistant to the vice president, manufacturing.

Spiron Inc, Silver Spring, Md, has elected **Gordon Moos** vice president in charge of the Fastener Division. He was formerly assistant to the vice president in charge of sales and production for Waldes Kohinoor.

Hayes Steel Products Ltd, Merritton, Ont, a partially owned Canadian affiliate of Dana Corp, has elected **Rene C McPherson** president. He has been serving as executive vice president of Hayes, a leading Canadian maker of parts for the automotive and general transportation industries.

Industrial Tectonics Inc has appointed **John D Goodall** general manager of the Ball Division in Ann Arbor, Mich. He succeeds **Helmut F Stern** who remains as president of both the Ball and Bearing Divisions. Mr Goodall was head of his own management consulting firm before joining Tectonics.

Ampex Corp, Redwood City, Calif, has elected **Erwin Tomash** vice president of the corporation and manager of **Ampex Computer Products Co,** Culver City, Calif. Mr Tomash was formerly an officer of Telemeter Magnetics Inc which was merged last December into Ampex Corp.

American-Standard Industrial Division, Dearborn, Mich, has appointed **Fred J Robinson** service manager. He has been divisional service supervisor since 1959.

Sheffield Corp, Dayton, Ohio, subsidiary of Bendix Corp, has named **James S Gorrell** treasurer. He has been serving as plant manager of the Hamilton Division.

Threadwell Tap & Die Co, Greenfield, Mass, subsidiary of Sheffield Corp, has named **Thomas W Clark** president and general manager. Mr Clark, a Threadwell vice president, replaces **Roy Heldenbrand** who has been made vice president in charge of operations at Sheffield

Clearing Division of US Industries has appointed **Albert R McCallum** a special automotive consultant. Mr McCallum is retired general master mechanic of the Fisher Body Division of General Motors

DeVlieg Machine Co, Royal Oak, Mich, has promoted **Robert M Miller** of the sales staff to assistant sales manager of the Machine Tool Division. He will be concerned primarily with sales of the company's Jigmil boring machines and Micropoint cutting tool grinders

Size Control Co, a division of American Gage & Machine Co, Chicago, has appointed **Peter J Sommer** vice president and general manager. He was previously superintendent of the Plain Gage Department. **Thomas J Owen,** supervisor of the Thread Gage Department, has been named vice president, manufacturing, and **Frank J Vlasaty,** director of research engineering, has been made sales manager.

Clearing Division of US Industries has appointed **Norton D Skinner** manager of technical services for the International Division. Associated with Clearing for the past 18 years, Mr Skinner has been instrumental in the design of many features used in the firm's press equipment.

New Britain Machine Co has appointed **Richard M Johnson** a group vice president in charge of three of the corporation's operations. Mr Johnson is president of Koehler Aircraft Products Co, a Dayton, Ohio, subsidiary.

Thor Power Tool Co has named **William C Adamson** works manager of the main plant in Aurora, Ill. Prior to joining the company Mr Adamson worked with the director of manufacturing at Cummins Engine Co, Columbus, Ind.

Gisholt Machine Co, Madison, Wis, has appointed **Robert H Presnall** general sales manager. Formerly assistant sales manager, he replaces **Robert H Bruce** who has retired.

Ex-Cell-O Corp, Detroit, has named **Russell D Hughes** assistant general manager of the Costa Mesa, Calif, plant of **Cadillac Gage Co,** a subsidiary. Mr Hughes has been controller at Ex-Cell-O.

Philadelphia Gear Corp, King of Prussia, Pa, has named **Harold O Kron** vice president, engineering. He moves up from the post of chief engineer.

Boeing Airplane Co has appointed **Donald J Euler** general manager of the Industrial Products Division. Mr Euler, formerly director of planning at headquarters, will become a vice president of the company.

Electric Autolite Co, has named **J B Driscoll** manager of production at its new plant in Decatur, Ala. He has been production superintendent at the Champlain St plant of the Toledo division.

Ultrasonic Industries, Plainview, NY, has named **Bernard Kardon** director of engineering. Mr Kardon is a cofounder of Harman-Kardon Inc, manufacturer of sound reproduction equipment.

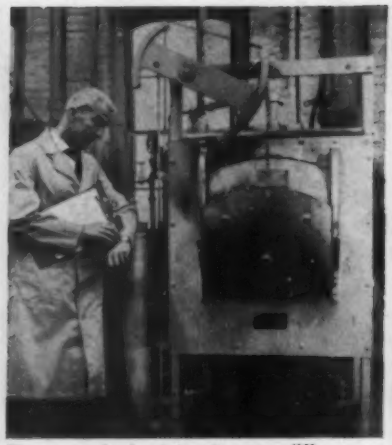
Stearns Magnetic Products Division of Indiana General Corp, Milwaukee, has named **Harold W Buus** general manager. Formerly director of research and development, he succeeds **Frank S Greenwald** who has been named manager of product development for the parent corporation. **William G Luedtke** has been advanced from chief engineer to director of engineering. •

Beryllium Corp, Reading, Pa, has appointed **Drew W Perkins** engineering director. He was formerly associated with Olin Mathieson Chemical Corp as manufacturing-engineering superintendent

KPT Mfg Co, Roseland, NJ, organization with facilities for high precision machining and welding, has elected **J W Mollek Jr** president. He was executive vice president of the **Kidde Precision** Tool Corp which was sold recently and renamed KPT Mfg Co

NEW TOOL STEEL SERVICE

reduces heat treating costs



The man who heat treats many different tools..

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He'll operate his furnaces more efficiently and profitably because

he'll now be able to heat treat many more tools at one time.

He'll know exactly how each grade responds to heat treating.

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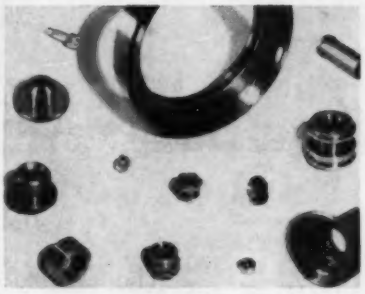
CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA

Universal Cyclops Introduces Free-Machining 303 Stainless

The development of this new type of 303 stainless steel promises significant advantages over the regular AISI Type 303 stainless. Called Uniloy 303MA, the new free-machining chromium-nickel stainless is said to have greater machineability, more resistance to corrosion, and a greater resistance to splitting than its standard 303 counterpart.

Worked in actual production operations, Uniloy 303MA increased output of machined parts, lengthened tool life considerably, and was machined into parts having higher quality, better performance properties, and a higher finish—at less overall cost—than those made of regular free machining Type 303 stainless.



Some of the parts being turned from this new 303-type free-machining stainless

Sulphur and aluminum additives

Key to 303MA's superiority to Type 303 is the patented combination of sulphur and aluminum as components in the alloy. The sulphur content of the new steel is about one-half that used in regular 303, and aluminum is a new additive not used in Type 303.

The proper combination of sulphur and aluminum in 303MA not only increases machinability; it reduces harmful effects of high sulphur content on the fabrication and performances of finished parts; corrosion resistance of the new steel is nearly 30 times greater than regular 303 stainless, approaches that of Type 304, and is close to Type 316.

Uniloy 303MA can be welded

The new stainless steel has additional workability characteristics that are not practical or possible with regular Type 303 stainless:

- 303MA can be welded by the arc, flash, or percussion stud methods when proper techniques are used.
- The metal can be roll threaded to an excellent surface finish.
- It can be electropolished to a very high luster with results that are similar to those obtained with low sulphur stainless steels such as Types 302 and 304.
- Uniloy 303MA can be brazed with proper preparation and techniques. Dry furnace or vacuum brazing are recommended.
- The new steel has a cold workability that is satisfactory to 67% or higher reduction.

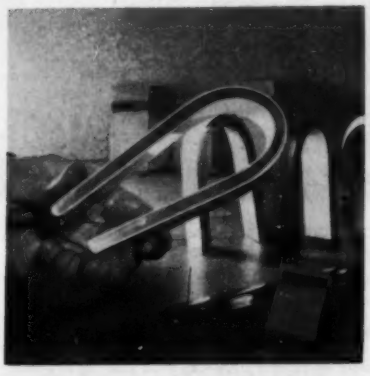
Manufacturers claim savings

Manufacturers who have used Uniloy 303MA in their operations have found that the new metal gives outstanding results. Typical comments stressed significant reductions of rejected parts because of splitting; surface finish improvement; substantial savings in production and inspection time; smoother, cleaner parts; and general cost reduction. One New England seal manufacturer estimates use of 303MA will save his company about $20,000 a year.

Uniloy 303MA is stocked in all popular bar sizes in rounds, squares and hexagons. Forging billets, forgings, plates, sheets, strip, and wire are also available.

Universal-Cyclops Steel Corp, Bridgeville, Pa

MORE DATA? Circle 66, inside back cover



Bonded Plastic-Clad Steel Plate Highly Resistant To Corrosion

Said to be the first time that plastic has been permanently "clad" or bonded to steel, this plastic-clad steel plate combines the strength of steel with the protection of plastic. The new material is expected to have wide application in the chemical industry for shortage tanks and vessels where purity of bulk chemicals must be maintained.

In addition to its non-corrosive protective qualities, the plastic-clad steel plate can be rolled into tanks or pipes, pressed into heads or shaped into various forms for industry, and easily welded for fabrication. Tests have shown its ability to withstand twisting, bending, heat up to 150 F, and cooling to subfreezing range.

The plate is also resistant to seawater corrosion and many uses are foreseen in the maritime industries as well as for storage and processing tanks used in conversion of saltwater to fresh water.

Lukens Steel Co, Coatsville, Pa

MORE DATA? Circle 50, inside back cover

New Paste Solder Features Residue Removal By Water

A paste solder (solder alloy, flux and neutral binders in stable suspension) has been designed for tough to solder stainless steel materials. Features of the new material are:

- Claimed to be the first paste solder material to combine an acid type flux and easily removable residue.
- Residual particles can be easily removed after soldering by dipping in water while hot, or soaking cool.
- Soldering of tough grades of stainless steel such as the 304 and 430 grades can be easily and inexpensively automated.
- The ability to hold the solder alloy in place—even on vertical surfaces—and give maximum fill.

Fusion Engineering, 17921 Roseland Ave, Cleveland 12, Ohio

MORE DATA? Circle 67, inside back cover

Adamas Carbide's Record at Ford

...proves it pays to select by performance!

ADAMAS JOB REPORT FOR:

Ford Motor Company

PLANT: Sterling Plant, Warren, Mich.

PART(S): Ford Rear Axle Shafts—No. 4235

MATERIAL: SAE-1038 Steel Forging, Brinell 179-229

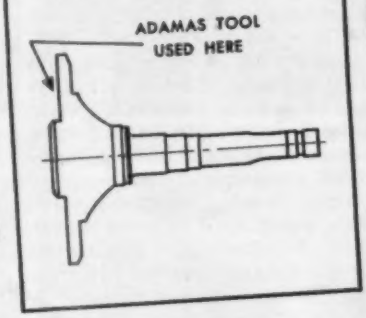
MACHINE: Snyder Lathe

OPERATION: Flange Facing—6.47 flange OD to 2.46 pilot diam. ... 930 to 360 sfpm. ... feed .016 ... depth of cut .030 to .090 variable

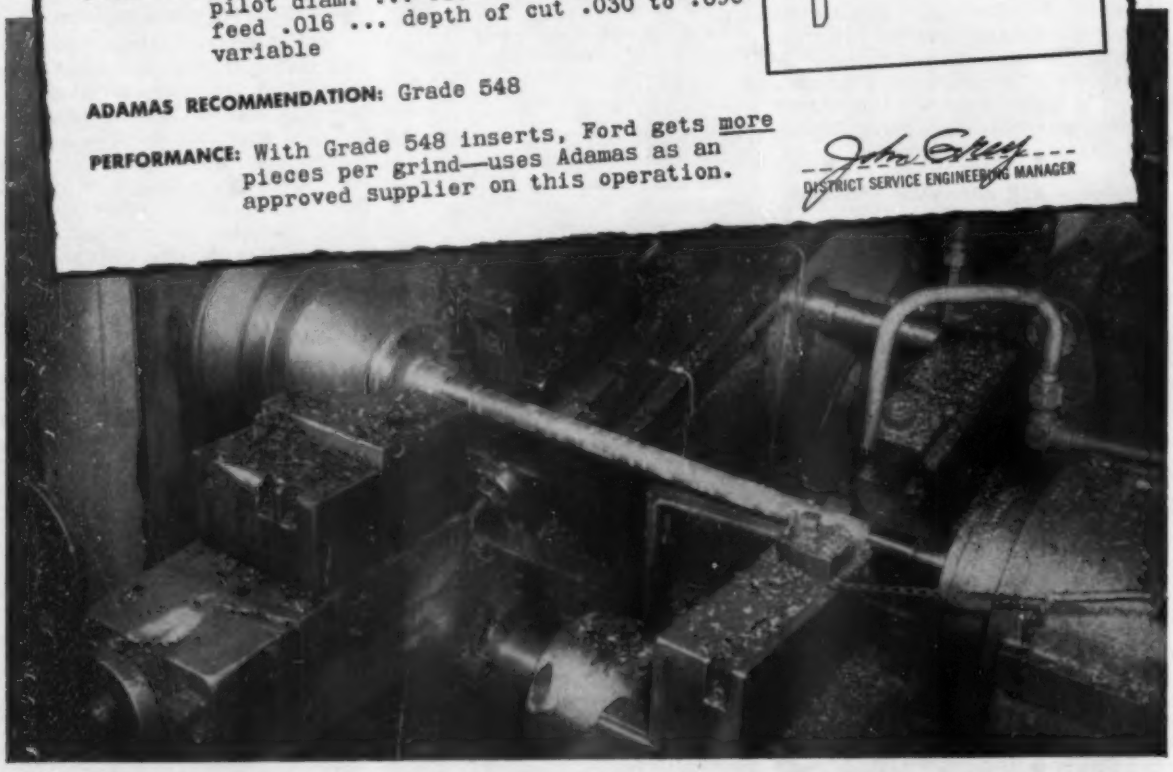
ADAMAS RECOMMENDATION: Grade 548

PERFORMANCE: With Grade 548 inserts, Ford gets more pieces per grind—uses Adamas as an approved supplier on this operation.

OPERATIONAL DIAGRAM



John Gray
DISTRICT SERVICE ENGINEERING MANAGER



■ The ability of Adamas Grade 548 to face flanges on more rear axle shafts, at minimized tool grinds, has greatly assisted in enabling Ford to substantially increase production. It has also played a part in Ford's obtaining lower tool costs ... longer tool life ... less machine downtime ... faster feeds ... variable speeds ... virtual elimination of rejects.

■ Grade 548's record 6-year run at Ford: optimum capability for consistent high performance and profitable volume production ... Another outstanding example of what is being accomplished by Adamas in plants of all sizes throughout the country.

■ Adamas produces standard and special tungsten carbide products for every metalworking application. For details on Adamas Performance-Proved carbide products best suited to your requirements contact your nearest Adamas representative or write direct.

FREE: Ask for your copy of NEW ADAMAS PRICE LIST No. PL-960.

Producers of Tungsten Carbide Tools, Tool Tips, Dies, Wear Parts, Dex-A-Tool, Dex-A-Mill

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

PROGRESSIVE CARBIDE USERS SELECT BY *Performance*...NOT HABIT!

Celanese Corp's Celcon Plastic Should Replace Metal in Many Industrial Uses

Celcon, a new high-strength plastic, has been developed by Celanese for use as a metal replacement in such volume markets as the automobile, appliance, industrial equipment, container, and hardware industries. Company officials estimate the market in these areas for high performance engineering plastics, such as Celcon, to triple in size during the next three years and reach a level of about 200 million lbs a yr by 1970.

Chemically classified as an acetyl co-polymer, Celcon is said to have all the properties required of a high-strength enigneering plastic: hardness, stiffness, dimensional stability, light weight, and resistance to abrasion and environmental attack.

Machined like brass

The new plastic may be sawed, drilled, buffed, polished, and otherwise machined using tools and speeds similar to those needed with brass. Field tests have shown Celcon to have the proper qualities for injection molding, extrusion, and blow molding. High temperatures, and resistance to most chemicals, including alkalis, are said to have little effect on the material's ability to carry heavy loads over an extended period of time.

Claim advantages over metals

The largest immediate use of Celcon is expected to be in the replacement of die-cast zinc and aluminum, brass, copper, and steel. Advantages over metals are said to be lower costs, greater design versatility, less weight, and elimination of costly finishing and assembly procedures.

Another principle application of the new plastic will be in the replacement of other plastics where Celcon's performance, processing qualities, and appearance will make it a preferred material.

Expect increased use in autos

With the current model cars averaging about 22 lbs of plastic, the automotive industry is considered a major market for Celcon. Its high strength and heat resistance is expected to boost use of decorative and functional plastic automotive parts to about 60 lbs per car by 1970.

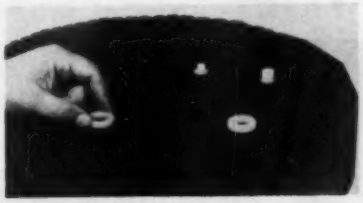
Other typical markets seen for Celcon: machinery gears and bushings, business machine housings and components, communications equipment, appliances, packaging, conveyor belt sections and links, pump housings, hose couplings, and many other industrial and consumer applications.

Now in production

The versatile new plastic is now being produced in pilot plant quantities at the company's Clarkwood, Tex, plant. Construction has already begun on a multi-million dollar Celcon plant at Bishop, Tex. It is expected on-stream by Jan, 1962.

Celanese Corp of America, 180 Madison Ave, New York 16, NY

MORE DATA? Circle 94, inside back cover



Black Granite Lapping Plate Finishes Teflon, Other Plastics

A new hand lapping plate designed to produce fine finishes on Teflon, nylon and other nonferrous materials is said to be noncontaminating. Made of black granite, the plate leaves the lapped part completely free from foreign matter.

The company claims three advantages of its granite lapping plate over conventional cast iron surface plates:

- Finer surface finish
- Cleaner, attractive appearance
- Elimination of the danger of a contaminator causing malfunction of the lapped part.

The new plates come in two sizes: 12-in. dia x 3-in thick, or 18-in. dia x 3-in. thick.

The Do-All Co, Des Plaines, Ill

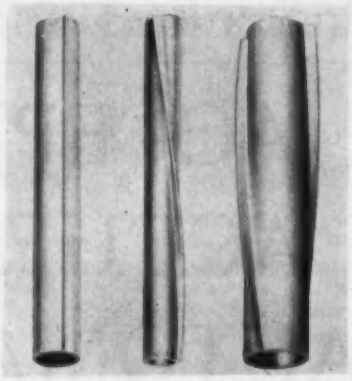
MORE DATA? Circle 95, inside back cover

Temperature Indicating Pellets 1% Accurate in 3000 F Range

Temperature indicating pellets are now available for 2800, 2900 and 3000 F. The pellets are said to melt within 1% of their indicated temperature points, thereby providing a convenient means of determining high heat levels.

Tempil Corp, 132 W 22nd St, New York 11, N Y

MORE DATA? Circle 96, inside back cover



INTEGRAL FINNED TUBING is manufactured by precision cold finishing methods for fuel elements and heat exchangers in nuclear reactors. Straight finned tubing, left, and spiral finned tubing comes in ¼ to ½-in. outside diameter with wall thickness from 0.030 to 0.060 in. As many as eight fins per tube can be supplied—*Superior Tube Co, Norristown, Pa*

MORE DATA? Circle 97, inside back cover

Release Agent and Mold Lubricant Has Variety of Applications

PartLube 100, packaged in aerosol container, is a dispersion of specially prepared waxes designed for use with a range of materials including plastics, ceramics, Shaw Process castings, acrylics, epoxies, rubber, cement, gypsum, and alkyds. It can also be used in metal stamping, dry lubriation of doors and self-tapping screws, lubrication for tapping, drilling and trimming operations, and as a rust inhibitor.

One pass will give perfect results, according to manufacturer, and because of high adhesive qualities it will remain on the surface through several cycles.

British Industries Corp, 80 Shore Rd, Port Washington, NY

MORE DATA? Circle 98, inside back cover

Quick-Drying Graphite Lubricant Is Designed for Heavy Equipment

Mexacote—a quick-drying, non-toxic graphite lubricant for use on railroad and heavy industrial equipment—is compounded from a blend of Mexican graphite and special oils. The lubricant is thinned with turpentine, naptha, or oleum spirits, and applied by brush, swab, or spatula.

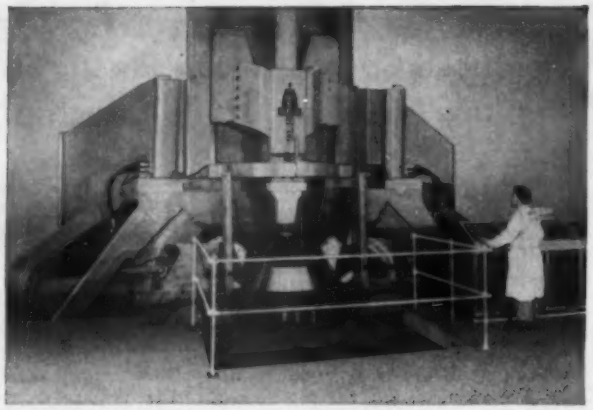
Upon application, Mexacote is said to dry as a tenacious, durable coating with max surface lubrication.

The United States Graphite Co, Div of Wickes Corp, Saginaw, Mich

MORE DATA? Circle 99, inside back cover

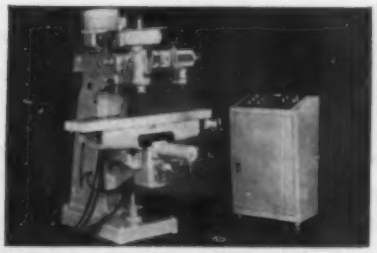
(Continued on page 230)

ACCEPTED ACCURATE AUTOMATIC



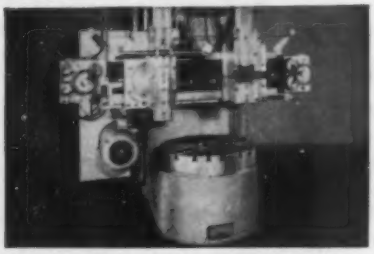
Hufford Corporation spin forge machine with *two* Honeywell 360° Tracer Control Systems plus spindle speed control.

HONEYWELL ELECTRO HYDRAULIC TRACER SYSTEMS



Gorton Vertical Milling Machine equipped with Honeywell 360° Electro Hydraulic Tracer Control System.

Frauenthal vertical contour (radome) grinder with Honeywell Electro Hydraulic Tracer Control System.



Giddings & Lewis Vertical Mill with two Honeywell 360° Electro-Hydraulic Tracer Control Systems.

Now operating on a wide variety of well-known machine tools (some of them illustrated at the left), Honeywell 180° and 360° Tracer Control systems provide fast, accurate and reliable system response for smooth application of large increments of hydraulic power.

They combine the flexibility, remote control and finesse of electronics with the power and fast actuation of hydraulics. They're far more flexible than completely hydraulic systems. These systems have been designed for ease of application. Modular construction simplifies and speeds field service.

ACCURACY—Accuracies of + .0005″ from template to part and + .0002″ from part to part have been achieved in actual use.

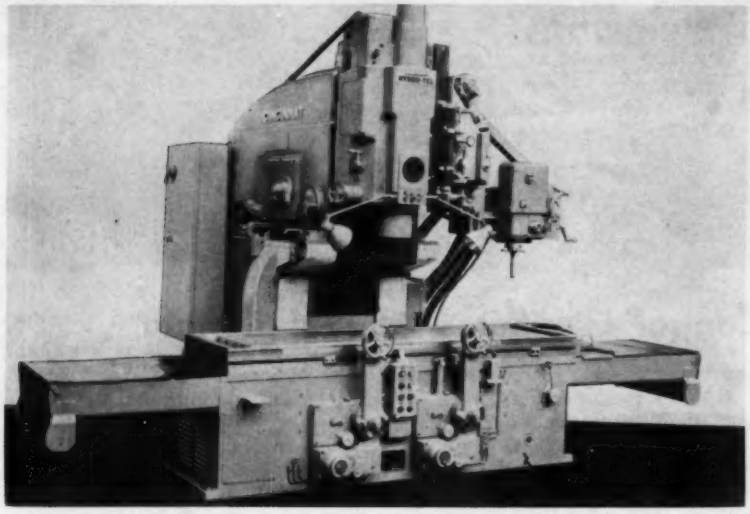
ADAPTABILITY—These systems are now in operation on all types of machine tools, from light duty engine lathes to huge spin forging machines. Every application is custom fitted—at production line prices.

PERFORMANCE—Each Honeywell system becomes an integral part of the machine tool. The control system can be adjusted to compensate for changes in machine performance during the life of the machine. Speed range of 300 to 1 is normal; greater rangeability is available on some applications. Tracing speed ranges up to 60″ per minute are available.

For further information on Honeywell's new machine control systems and components and their application to your specific job, contact Minneapolis-Honeywell, Machine Control Group, Dept. AM-3-61, Minneapolis 8, Minnesota. *Sales and service offices in all principal cities of the world.*

Honeywell

H First in Control



Cincinnati Vertical Hydro-Tel Miller Does Die Sinking, Automatic Profiling

This 28-in. Vertical Hydro-Tel milling machine, which is available in 10, 15, or 20-hp models, comes with longitudinal table travel of 60, 96, or 120 in. In addition to being a general purpose, manually controlled mill, the new machine does die sinking, automatic profile milling, and multiple spindle production milling.

Table and cross slide feeds are infinitely adjustable from 1 to 25 ipm or ½ to 12½ ipm; vertical head feeds range from 1 to 15 ipm. There are 16 spindle speeds, six optional ranges for the 10 and 15 hp drives, and four for the 20 hp drive. The spindle nose conforms to Cincinnati's Arbor-Loc design, and spindle lock and jog feature are said to aid quick change.

Attachments available

Because several automatic tracer units can be added to the basic machine, it adapts to a variety of die-sinking and other complex form-milling applications. Hydraulically powered handwheels remove physical effort from manual traverse of table and cross-slide.

An Hydraulic Automatic Depth Control Unit, which can be added, automatically controls duplication and production of dies and other intricate shapes. It consists of a completely automatic tracer control mechanism for controlling the vertical movement of the spindle head, thus automatically determining the vertical position of the cutter. It not only reproduces full scale master shapes; also, for shapes in which the same portions remain constant along one axis, sheet steel templets can be used.

An Automatic 360° Hydraulic Profiling mechanism turns the Hydro-Tel into an automatic profile miller, which handles both external and internal profiles with equal ease.

A Universal Automatic Combination Tracer combines advantages of both the automatic depth control and automatic 360° profiling tracer. With it, the operator can perform either depth or profile tracing operations separately, or simultaneously, from a single tracer finger. The change-over from one method to the other is made practically instantaneously, with a single control knob. Contact pressure of tracer finger is very light; therefore, wood, plaster of paris, or other easily worked materials can be used as master shapes.

Milling Machine Div, The Cincinnati Milling Machine Co, Cincinnati, 9, Ohio

MORE DATA? Circle 51, inside back cover

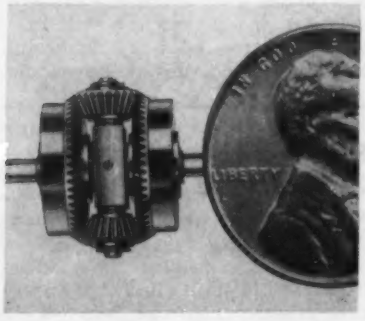
Electronic Welding Units Join Thin Metallic Precision Parts

A new line of stored-energy welding equipment is designed especially for manufacturers of precision electronic components made from thin metals. The line includes six different stored-energy power supplies, five weld heads and handpieces.

The electronic welding units feature ultra-short discharge time, fully metered controls, input voltage regulation and a packing concept that allows standard production bench mounting without the need for special installations.

Marketing Dept, Vacuum Tube Products Div, Hughes Aircraft Co, 2020 Short St, Oceanside, Calif.

MORE DATA? Circle 52, inside back cover



Sub-Miniature Differential Line Features High Precision

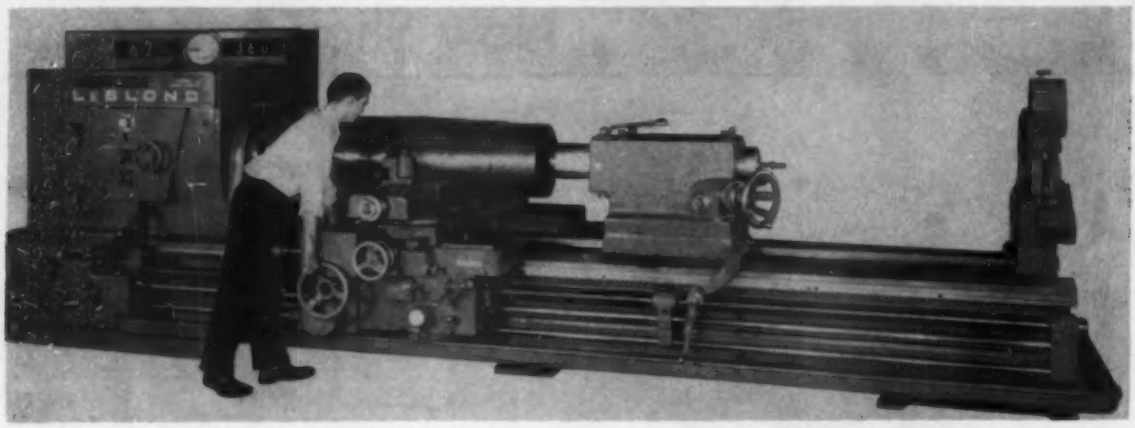
This new line of sub-miniature precision differentials—designed for highly critical applications in computer assemblies and control instruments—has backlash of 8 min or less, and break-away torque to 0.02 oz-in. Made entirely of stainless steel, each differential has six minature ball bearings which conform to ABEC 7 tolerance requirements.

The differentials are available with either 0.0779 or 0.0935-in. dia shafts with overall lengths up to 3 in. Pitch and number of teeth on end gears can be selected from a wide range. End gears are made from flat blanks that are parallel within 0.0002 in.

The two-spider-gear design's half-inch diameter swing permits extreme miniaturization.

Instru-Lec Corp, 520 Homestead Ave, Mount Vernon, NY

MORE DATA? Circle 53, inside back cover



LeBlond 'Servo-Shift' Control Eliminates Manual Shifting

Servo-Shift, which has been applied to the NK design heavy duty lathes and will soon be available on other models, is a new speed control unit which is said to eliminate manual gear shifting. On a dial, the operator sets cutting speed opposite workpiece diameter and presses the shift button. Then the lathe automatically shifts gears and runs at the spindle rpm which produces selected fpm.

If he chooses, the operator can select spindle rpm instead of fpm.

While making a pass on one diameter of the workpiece, fpm or rpm can be preselected for another diameter. Then, when the tool is moved to the new diameter, all the operator has to do to maintain a correct cutting speed is press shift button.

An optional remote apron control will further simplify control. This is especially desirable on long bed lathes, as it eliminates time-wasting trips to headstock controls. With this, an illuminated digital readout can show the exact fpm and rpm.

The R K LeBlond Machine Tool Co, Cincinnati, Ohio

MORE DATA? Circle 54, inside back cover

Floating Gearmotors Fit On Drive Shafts and Save Space

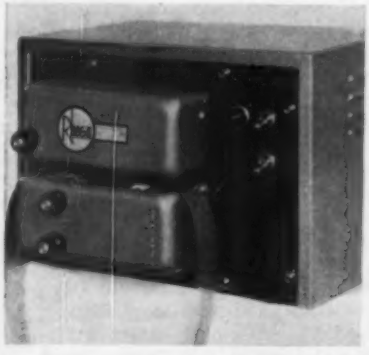
New floating gearmotors for runout table and heavy-duty conveyor applications are available in ratings from 1 to 15 hp. Called Verti-Seal, they feature a special seal which prevents lubricating oil in the gear casing from leaking into the windings of the integral motor mounted below the gear unit. Use of this seal is said to eliminate all wearing and brittle parts of conventional oil seals.

Other features and advantages:

- Single reduction worm gearing with a hollow low-speed shaft fitting over and keyed to the driven shaft.
- A spring loaded torque arm minimizing possible roll neck eccentricity and reducing shock caused by intermittent loading.
- Tapered roller-type bearings.
- Splash lubricated gearings and bearings (except for the upper worm bearing which is grease packed).
- Spline coupling to permit motor replacement without disassembling the gear housing from the driven machine.
- A 60% space saving over regular gear motors.

Westinghouse Electric Corp, PO Box 2099, Pittsburgh 30, Pa

MORE DATA? Circle 55, inside back cover



Rheem Photocell Reader Has Few Moving Parts and No Contacts

This new photocell reader, which was developed for use with the company's system of automatic numerical positioning controls for machine tools, is completely transistorized for long life. The sensing element is one piece of silicon containing eight information and one timing track channels. This eliminates focusing problems.

The reader, which has few moving parts and no contacts to wear out or give faulty readings, reads 5, 7, and 8-channel paper or aluminum Mylar tapes at 100 characters per sec. Output is 8 information and 1 timing signal, all appearing simultaneously.

Rheem Manufacturing Co, Electronics Div, 5200 W 104 St, Los Angeles, Calif

MORE DATA? Circle 56, inside back cover

'True' Bank Winding Machine Makes Random or Layer Winds

Said to be the first true bank winding machine to be offered as a marketable item, model 6 BW is used for the manufacture of variable auto transformers.

The company claims its machine will accurately overlap wire on the inside dia of a core while tightly winding it on the outside dia of the core. This gives an even "brush surface" allowing a wiper to pass over.

Wire size used on the machine may range from No. 28 to 8 wire.

Universal Manufacturing Co, Inc, 1168 Grove St, Irvington, N J

MORE DATA? Circle 57, inside back cover

Turntable Positioning Machine Handles Assemblies to 2000 lb

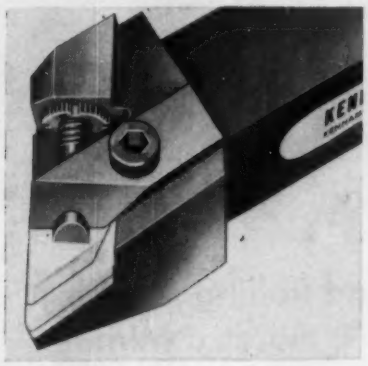
Turntable positioning machine, model PM-1051, is motor driven for precise positioning and rotation of work during welding or fabrication operations. The machine control panel provides for jogging of both turntable position and rotation drive motors.

Assemblies weighing up to 2000 lb may be mounted on the 32-in. dia flat machine face plate and secured to milled T-slots. The table can be tilted from vertical to 15 deg beyond the horizontal by the drive motor. A worm gear and drive provides either right or left hand table rotation with a selection of rotation speeds from 0 to 4 rpm; a calibrated rpm meter provides visual indication of speed.

Dimensions of the machine: length 53-in., width 34 in., height 46 in.

Boesch Mfg Co, Danbury, Conn

MORE DATA? Circle 58, inside back cover



PROFILING TOOL double locks inserts in tool recess. Insert is held against back walls by cam pin through the insert, and in its seat by a top clamp. Tool also features dial adjustment of chip breaker—*Kennametal Inc, Latrobe, Pa*

MORE DATA? Circle 59, inside back cover

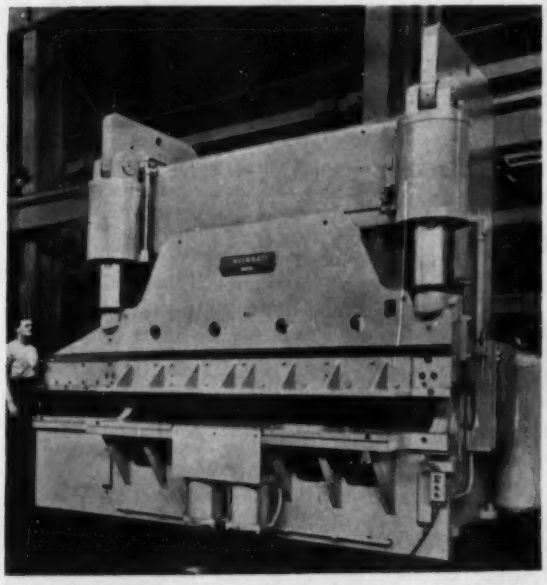
Broken Tool Detector Operates On Simple Magnetic Principle

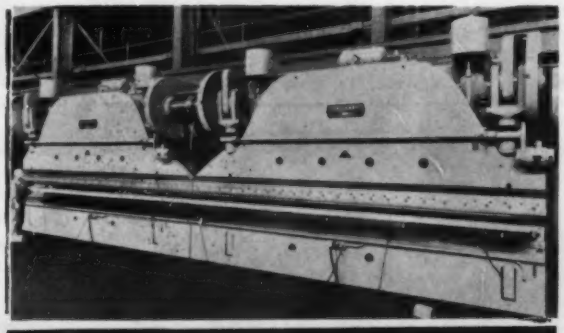
Model MEK-5910 Detect-A-Tool, which works on a simple magnetic principle, has sensing units mounted on the work station itself. Because magnetic principles are used, the maintenance and problems associated with mechanical devices are eliminated.

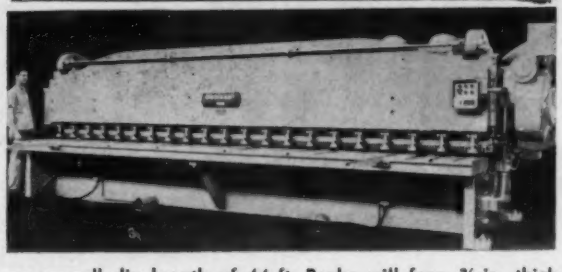
Failure of a tool is detected as soon as it occurs, and the Detect-A-Tool system can either stop the machine or provide a warning signal. The system can be installed on existing as well as new machinery.

Machinery Electrification, Inc, 56 Hudson St, Northboro, Mass

MORE DATA? Circle 60, inside back cover

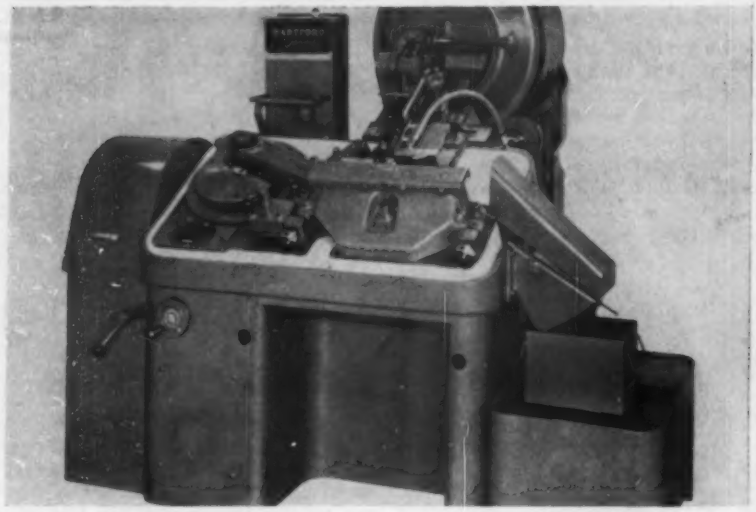






SOME OF THE LATEST PRESS BRAKES AND SHEARS from Cincinnati Shaper include: *Left*—Series 300H x 10 ft hydraulic press brake can be used as both a punching and bending machine. All controls are mounted at right hand end; two speeds to the ram offer both a fast pressing speed and a full tonnage pressing speed. *Top Right*—Two interlocked 34 Series x 16-ft press brakes give a mechanical brake with an overall die length of 44 ft. Brake will form 3/8-in. thick mild steel plate. *Bottom Right*—Series 4320 all steel shear cuts 3/16-in. x 20 ft mild steel, and is equipped with a 36-in. back gage range. Back gage adjustment is front controlled and power operated for quick, easy blank width settings—*The Cincinnati Shaper Co, P O Box 111, Cincinnati 11, Ohio*

MORE DATA? Circle 61, inside back cover



Hartford Special's Thread Rolling Machine Produces From 135 to 400 Pieces a Minute

This completely new automatic thread rolling machine—called Model 400-R by the Hartford Special Machinery Co, Simsbury, Conn, who manufacture it—can produce from 135 to 400 pieces per min. Thread lengths may be rolled from ⅛ to 1½ in. and can be extended through 3 in. with special dies.

Screw capacity is from No. 2 through 10 on the automatic model (400-R), and No. 0 through 10 on the manual model (400-M).

Both models feature adjustable starter fingers in which the height and stroke can be varied; the transfer finger has been eliminated. Because the relative position of the moving die is controlled by a simple eccentric cam adjustment, die matching is easy. Die spacing can be precisely adjusted with longer spacing.

Dist by Roy Machinery & Sales, Inc, New Britain Ave, Farmington, Conn

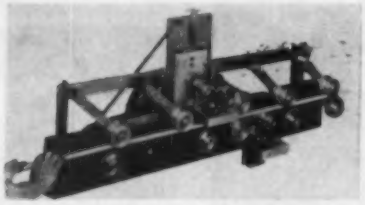
MORE DATA? Circle 62, inside back cover

Wallace Cut-Machining Unit Provides Machine-Like Finish

Surface finishes of less than 100 rsm can be achieved on the 2100 Series which can cut an 8-in. I-beam (weighing 18.4 lb per ft) in less than 18 seconds, and a 20-in. I-beam (weighing 65.4 lb per ft) in less than 65 seconds. Company reports that if a section to be cut can fit into a box 6 x 24 in., this machine can cut it (this excludes solids of that size). A 3 x 24-in. plate, or 72 sq in., can be cut in 4 minutes.

Wallace Supplies Mfg Co, 1300 Diversey Pky, Chicago 14, Ill

MORE DATA? Circle 63, inside back cover



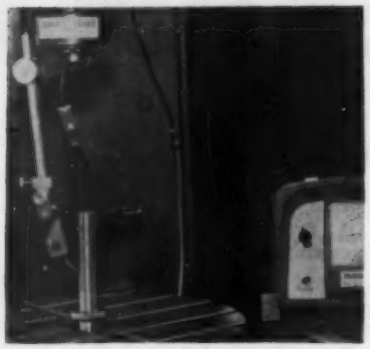
Tube or Rod Marking Machine Handles ⅜ to 3-in. Tubing

This printer marks color codes, cut-off marks, or any other identification on rigid or semi-rigid plastic, metal, or other tube or rod materials. Dual flexographic inking systems make possible the printing of neat, clear imprints with no smudging or blurring. Average output is 2 to 3 tubes per minute, depending upon size and handling requirements.

A bench-mounted unit, the marker is driven by a motor ranging from 1/3 up to ¾ hp, depending upon requirements. Tube feeding is manual but can be automated with optional equipment.

Industrial Marking Equipment Co, 655 Berriman St, Brooklyn 8, NY

MORE DATA? Circle 64, inside back cover



Pratt & Whitney Centering Gage Is Accurate to Few Millionths

Precision hole locating or centering from a machine tool spindle is said to be possible with the Trans-O-Limit centering gage. Accuracy of this gage, including linearity and repeatability, is 1% of full scale (¼ of one division on the scale). Resulting accuracy in the high magnification range is 2½ millionths of an in.

The gage consists of a height gage head, slip-ring assembly, gage head support arm, and interchangeable arbors for different mountings. Two instrument cabinets with different amplifiers are furnished. One has a four-way range switch providing magnifications of 0.0005, 0.001, 0.005, and 0.010 in. full scale. The other cabinet has a two-way switch providing magnifications of 0.001 and 0.010 in. full scale.

Trans-O-Limit adjusts for a radial capacity of between 23 and 19-in. OD, and a depth capacity of 8⅜ to 15⅛ in. depending on the configuration of the part.

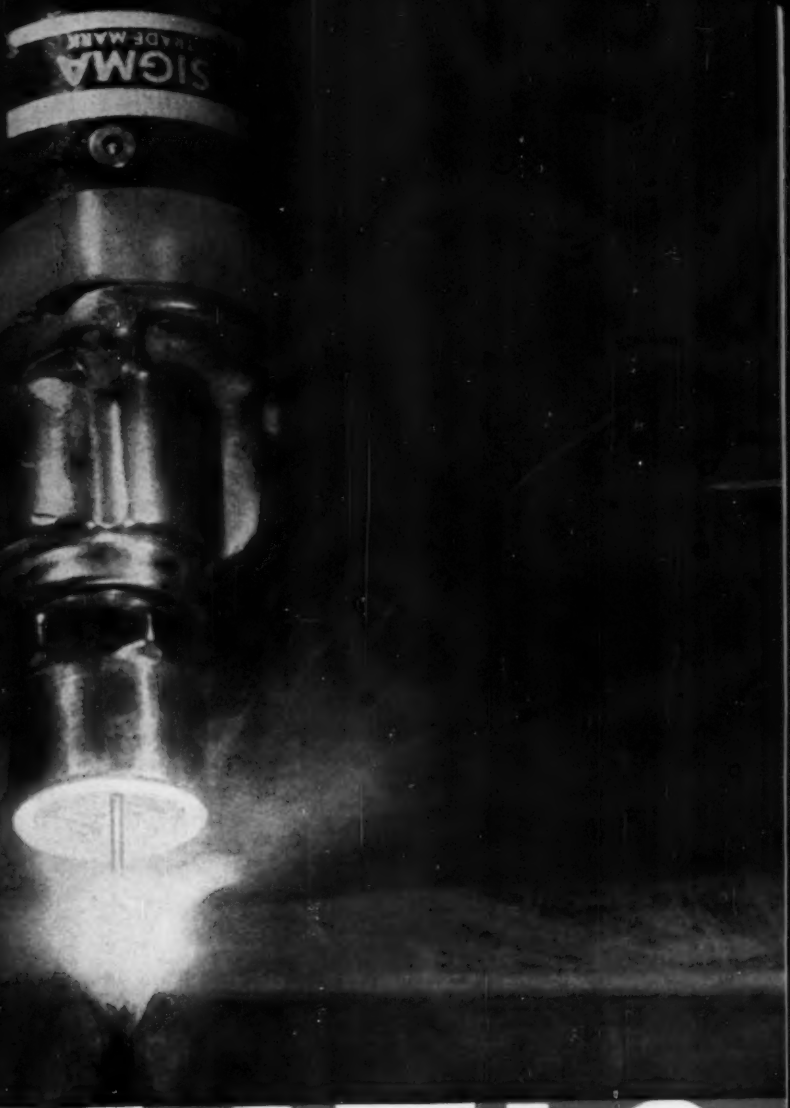
Principle uses of the gage: positioning and aligning work on machine tables, checking spindle runout; measuring holes, plugs, and bosses for squareness, taper, roundness, bellmouth, concentricity, and center-to-center distances.

Pratt & Whitney Co, Inc, West Hartford, Conn

MORE DATA? Circle 65, inside back cover

LINDE COMPANY

UNION CARBIDE



SIGMATIC

NEW ALL-IN-ONE "MIG" WELDING EQUIPMENT

Welding equipment is designed, developed and refined, but eventually it must be redesigned. LINDE'S new SIGMATIC line of "Mig" welding equipment is a product of this evolution . . . plus LINDE'S vast experience with more inert-gas and consumable-electrode processes than any other company in the world. The SIGMATIC line is the most-versatile semi-automatic equipment available anywhere—one machine for:

- **. . . all types of "Mig" welding—spray arc, short arc and spot welding**
- **. . . in all welding positions—vertical, overhead or downhand**
- **. . . with all shielding gases—argon, helium, CO_2, or their mixtures**
- **. . . and all wires—hard or soft, solid or tube**
- **. . . on all weldable metals—carbon steel, stainless, aluminum, magnesium, titanium**
- **. . . on all thicknesses—sheet metal and up**

See next page for details.

SIGMATIC

One SIGMATIC machine for... spray arc... short arc... spot welding

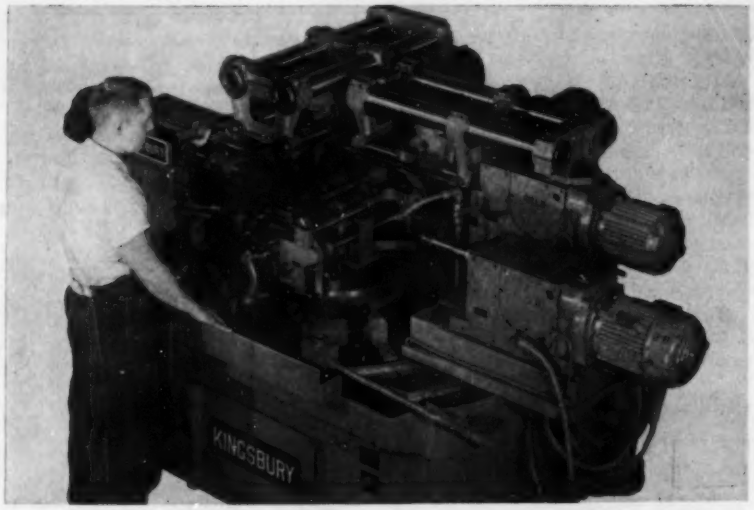
Spray arc, short arc, spot welding... never before combined in a single piece of equipment. SCC-8 control incorporates special spot-welding circuitry, featuring a directly-calibrated, precision weld timer and an independently-adjustable, "non-stick" timer. Converts from spot to continuous fusion welding at the flick of a switch. SEH-2 heavy-duty wire-feed unit—largest, most-rugged unit available today—permits positive feed of all "Mig" wire types, metals and diameters. The SIGMATIC line contains five basic units, designed with interchangeable parts permitting more than 50 combinations tailor-made to individual specifications. Available in cart-, sled- or bench-type units.

Unique controls are vastly simplified. All components are visible and accessible. Adjustments can be made with a screw driver. Only heavy-duty industrial-type parts are used throughout each unit to insure dependable, long-life performance with minimum maintenance. Top-quality parts—"Square D" pneumatic timers, Mallory electrolytic condensers, Cutler-Hammer switches, Potter & Brumfield relays, Electrons, Inc. thyratron tubes. The SIGMATIC line is unquestionably a major welding advance—with one rugged, durable machine, you can do any type of "Mig" welding in any position on any thickness of any metal. For more information or a live demonstration, call your nearest Linde office.

"Linde," "Sigmatic" and "Union Carbide" are registered trade marks of Union Carbide Corporation

LINDE COMPANY UNION CARBIDE

Division of Union Carbide Corporation
270 Park Avenue, New York 17, N.Y.



Kingsbury Machine Performs 5 Operations To Turn Out 135 Camshafts Per Hour

This machine drills, mills, counterbores, countersinks and taps automotive camshafts at a gross rate of 135 parts per hour. The machine's four stations finish a piece every other index with a selective trip cycling the proper units at each index.

The five unit machine has a 24-in. index table which holds two work fixtures by manual clamping and unclamping. Two arms, actuated by a single handle through an equalizing cam, clamp the work piece against fixed vees. One clamp is at an angle so that the workpiece is pushed against a stop for proper location. Both workpieces are in parallel.

Three of the machine's units operate on one cross hole, while two units have milling heads for a flat and keyway.

Kingsbury Machine Tool Corp, Keene, NH

MORE DATA? Circle 71, inside back cover

New Rod Ends Have Bearings Which Add To Long Service life

Large size rod ends, control rod assemblies, and high angle rod ends with studs are said to permit sustained rotational operation. The patented Alinabal bearings of these fixtures have capacities which the company claims are greater than those of conventional rod ends.

The Alinabal design uses a race radius slightly larger than the ball radius which eliminates binding at the edges of the race when the bearing is under load. This is said to insure controlled distribution of the load in the contact area which, in turn, contributes to long service life of the units.

Split Ballbearing, Div of MPB, Inc, Leabanon, N.H.

MORE DATA? Circle 72, inside back cover

Tensile Tester Comes in Seven Models For Tests Up To 500 Lb

Series TJ Tensile Tester can accurately perform tensile tests up to 500 lb for a variety of small parts or material samples. The air actuated, portable unit is designed for bench mounting and easy operation. The company claims the new tester combines laboratory accuracy—one-half of one percent of the full scale reading—with production speeds.

The standard Series TJ Tester has a maximum jaw opening of ¼ in. Maximum travel of the moving jaw is 2 in., and the minimum sample length is 1 in. However, these factors can be varied by modification of the instrument, or, in some cases, by simple adjustments.

There are seven models of the tester with capacities of 20, 50, 75, 100, 150, 100, or 500 lb. Overall dimensions are 28¼ x 4½ x 8 in. and the instrument weighs about 35 lb.

Quality Control Equipment Dept, Hunter Spring Co, Div of American Machine & Metals, Inc, 1 Spring Ave, Lansdale, Pa.

MORE DATA? Circle 73, inside back cover

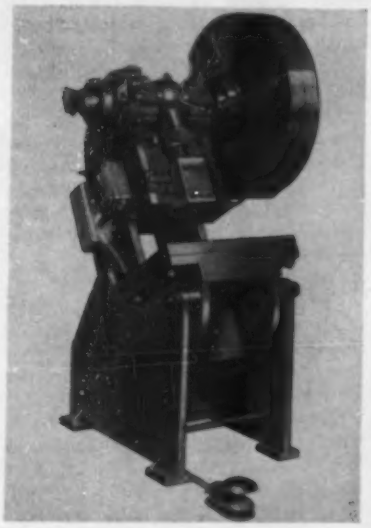
Recorder Controller Offered For Protective Gas Atmospheres

Model 30D automatically records and controls the dewpoint of the protective gas atmosphere used in heat treating, brazing, and sintering operations. Since the dewpoint has a definite relationship to the other gaseous constituents, the oxidation and carbon potentials of the sampled atmospheres are capable of being controlled.

Advantages include elmination of condensation and evaporation of the water vapor and its extraneous contaminants of the gas sample; elimination of the refrigeration unit; only a water line is required when the instrument is operating over its usual range of –10 to +70 F dewpoint.

Barber-Colman Co, Industrial Instruments Div, Rockford Ill

MORE DATA? Circle 74, inside back cover



30-ton Capacity OBI Punchpress Is Rated at 120 Strokes a Min

Electrically operated press features a 30-ton capacity with 15% overload safety factor. Frame is all-steel welded and stress relieved. The pin-type non-repeat clutch is converted to repeat by turning a switch. Opening through back is 12 in. wide with an 3½-in. throat depth and 12½-in. throat height. Frame can be inclined 30°.

The press is operated by a movable foot trip that may be placed where it is most convenient. Ram is held securely by V-type gibs for positive punch and die alignment. Length of stroke is 3 in. with 2½-in. ram adjustment. Punches and dies up to 6-in. rounds are stocked as well as irregular shapes and special sets.

Whitney Metal Tool Co, 801 Forbes St, Rockford, Ill

MORE DATA? Circle 75, inside back cover

Precision Slides Measure Surfaces Without Skids

Three new skidless pickup models are designed to measure very narrow or small areas such as flanges, thread flanks, gear teeth, and small internal diameters as well as O-ring grooves.

Model BK 3922F Precision Slide makes possible surface measurements without skids — the reference line, normally provided by the skids, being generated by the slide. Movement of the slide is produced by mechanical coupling to Model BK 3911 Power Trace. With this combination, stroke adjustments are thus controlled from lengths of trace from 0.005 to 1½ in. Surfaces of less than 1 microin. can easily be measured by the equipment mounted on the surface plate.

Model MP 0002SL General Purpose Skidless Pickup is particularly useful in the measurement of small IDs and ODs, flanges, thread flanks, gear teeth, or similar applications. Measurements can be made to within 0.020 in. of the shoulder. It must be used with the Precision Slide Power Trace. Model MP 6100SL is for hard-to-reach areas.

Cleveland Instrument Co, 6220 E Schaaf Rd, Cleveland 31, Ohio

MORE DATA? Circle 76, inside back cover

Link-Belt Takeup Frames Will Mount 143 Bearing Shaft Sizes

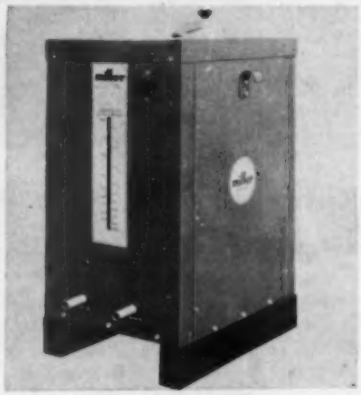
These new multi-bearing take up frames are especially designed to accommodate any type of bearing—babbitted, bronze, ball or roller—in any two-bolt pillow block with mounting holes up to ⅝ in.

Available from stock in 11 sizes, the frame allows horizontal bearing adjustments from 6 to 24 in. They will mount 143 different bearing shaft sizes from ⅝ to 2-7/16 in. dia. Mounting flexibility—one pad is moved by screw adjustment, the other slides freely—permits each size of takeup to accept a wide range of pillow block bore sizes.

Channels protect the adjusting screw and also provide easy access for lubrication and cleaning. Mounting feet, formed from heavy gauge steel, have two stiffening ribs for added strength and the pillow block mounting pads are welded steel.

Link-Belt Co, Dept PR, Prudential Plaza, Chicago 1, Ill

MORE DATA? Circle 77, inside back cover

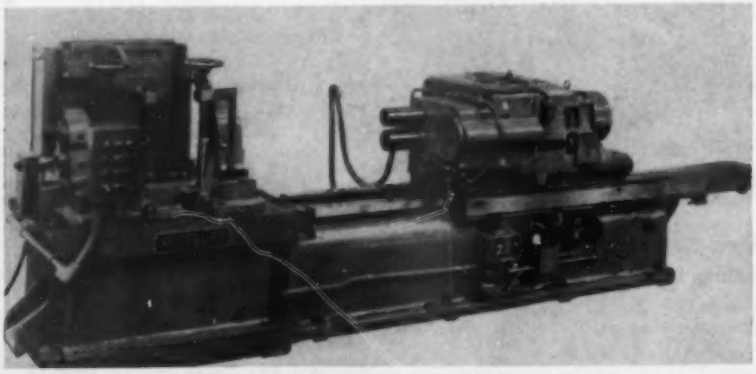


300 and 500-amp Welders Added to Miller Line

S Series is designed for use with ac or ac/dc electrodes. Features include movable coil design, 80-v open circuit, superior cooling, silicon steel cores, Class B insulated copper coils, dead front construction, and enamel finish on heavy-gage steel case.

Miller Electric Mfg Co, Appleton, Wis

MORE DATA? Circle 78, inside back cover

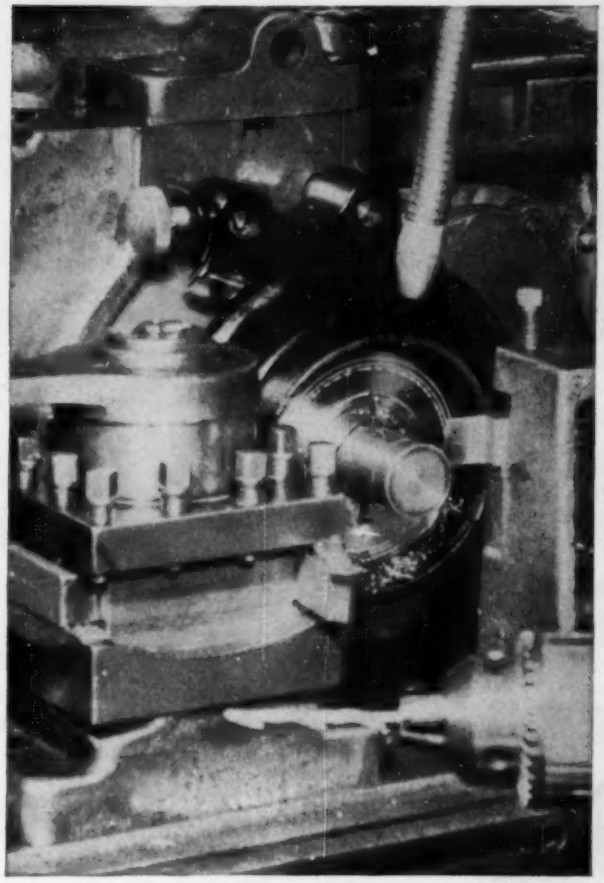


ONE-WAY, TWO-SPINDLE, CENTRAL-SYSTEM HYDRAULIC-FEED horizontal boring machine generates two long, high-precision holes simultaneously in large engine crankcases. Machine, which sizes babbit bushings of camshaft bore as well as boring the bearings, is for an extensive facility making diesel and automotive engines in Brazil—*The Foote-Burt Co, Cleveland 8, Ohio*

MORE DATA? Circle 79, inside back cover

V-R TANTUNG*...likes to work

...machines metals at faster sfpm with increased production and longer life than HSS



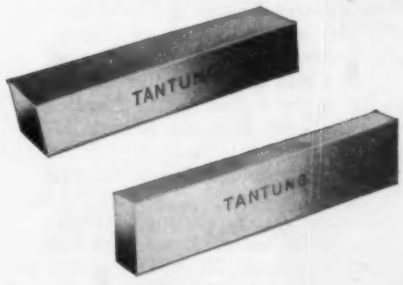
V-R Tantung holds its cutting edge hardness at temperatures well above those at which HSS "burns up." It has higher shock resistance than carbides. Tantung's high red hardness, high transverse rupture strength and low coefficient of friction make it the ideal tool material for intermediate cutting speeds . . . and it's easy to grind on aluminum oxide wheels of vitrified bond.

*Exclusive V-R Cast Alloy

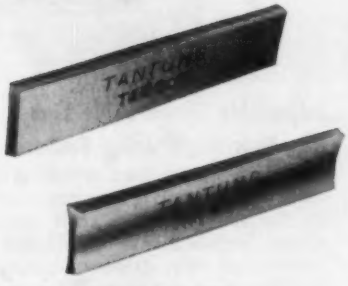
Comprised principally of cobalt, chromium and tungsten, V-R Tantung is poured from molten metal and cast in chill molds. Rapid solidification imparts high hardness, very fine grain structure and maximum strength. You should use versatile Tantung . . .

- **where higher speeds and feeds are desired than possible with HSS.**
- **for continuous production runs on all types of machines.**
- **where low surface speeds cause build-up on carbide tools.**
- **where machines lack power or rigidity for carbides.**
- **for multiple-diameter machining with carbide or HSS.**
- **for short runs on automatics where carbide is too costly.**

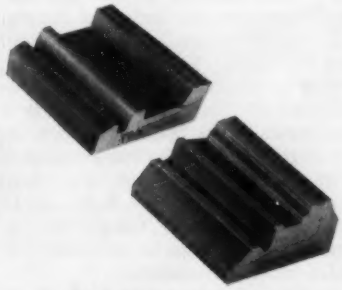
Your V-R distributor stocks Tantung tools. Call him or write V-R today to learn how Tantung can help you.



SOLID TOOL BITS



CUT-OFF BLADES



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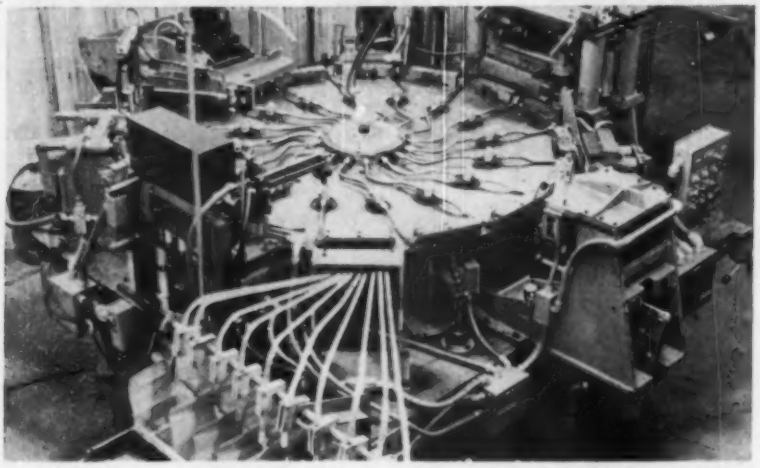


INDEXOMATIC DIAL-TYPE ASSEMBLY MACHINE makes "E" splices for joining telephone cable connections. Each of the 16 fixture nests on this machine contains 10 arbors. Cycle time is 3 sec; production rate is 12,000 assemblies an hr —*Gilman Engrg & Mfg Co, Janesville, Wis* MORE DATA? Circle 80, inside back cover

Star Profile Grinder Polishes And Grinds Irregular Shapes

Because No. 3 floor-type, tilting-table profile machine grinds and polishes contours and irregular shapes, it is said to be ideally suited for tool and die shops. The grinding wheel, which is mounted on a vertical reciprocating spindle, is centered in a counterweighted 18-in. dia work table that is accessible from all sides.

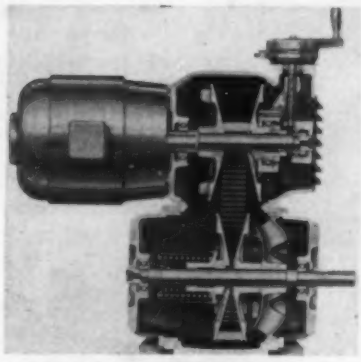
Standard pencil and cup type grinding wheels up to 4-in dia can be used on the machine. Larger size cup wheels are mounted on an arbor provided with the machine.

The grinder has wheel speeds of 4,500, 6,500, and 10,150 rpm. Total wheel reciprocation is 3/16-in. at 90 reciprocations per min. The unit occupies 24 by 30-in. floor space, has a table height of 38 to 44 in., and is powered by a 1½-hp motor.

Complete unit includes: two table center plates, a diamond dresser with diamond mounted nib, two cup wheel arbors, three socket wrenches, seven mounted pencil grinding wheels, and two cup-type grinding wheels.

Star Cutter Co., P.O. Box 376, 34500 Grand River Ave, Farmington, Mich

MORE DATA? Circle 81, inside back cover



Adjustable Speed Drive Line Has New Engineering Features

The Vari-Master line of mechanical adjustable speed drives are said to be the first type designed to customer requirements. Available in three sizes the drives incorporate the following engineering features:

- A fan on the adjustable speed shaft to allow maximum cooling of the belt for longer belt-life.
- Discs positively positioned by shaft shoulders eliminating the possibility of belt misalignment.
- Saddle mounting of the constant speed disc assembly on its own bearings, allowing vibration-free operation.
- Large sized discs to permit long, trouble-free belt life.
- Tight wrapping of the transmission case around the discs permitting maximum overall dimensions.
- Double-sealed, permanently lubricated bearings.
- Heavy chrome plated shafts and keys ground to close tolerances.
- Large grease reservoirs for discs, practically eliminating "stuck discs."

The Vari-Master line has a speed range of up to an 8 to 1 ratio of speed variation. Three sizes cover a range of from 1 to 10 hp supplied by a standard NEMA "C" face motor with standard shaft extension. The helical gear reducer is offered in double, triple, and quadruple step reduction, providing a large selection of output speeds. Assembled both horizontally and vertically to fit nearly any space requirement, the unit comes in drip proof and totally enclosed construction. Controls available: manual (handwheel), electric remote (push button), or pneumatic automatic.

Western Gear Corp, Industrial Products Div, PO Box 182, Lynwood, Calif.

MORE DATA? Circle 82, inside back cover

Automatic Bar Feed Feeds Stock by Air Pressure

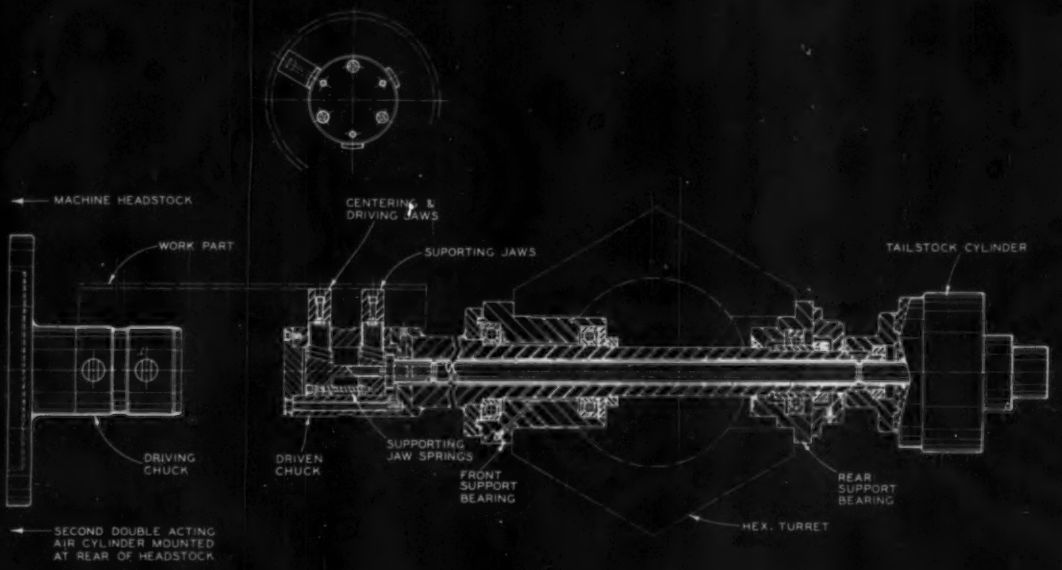
Round, square, or hex bar stock can be fed into lathes or screw machines automatically by air pressure with this unit and stock can be fed for any desired length to a fixed stop. All sizes and shapes within the capacity of the model can be handled without setup change. Height adjustment from 38½ in. to 50 in. on all models is provided by telescoping stands.

Standard equipment includes regulator, gage, valve, piston, and two adjustable stands. Tube ID is 9/16 to 4 in.; length 6 to 20 ft. Four models are available in 1⅜-in., 1¾-in., 2⅞-in., and 3¾-in. sizes. All have nominal capacity for 6-ft bars and will handle 12-ft bars. Special sizes can be furnished in capacities to 3¾ in. and in lengths to 25 ft.

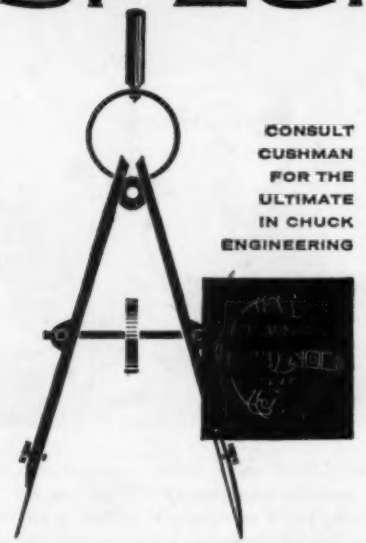
Power Grip Inc, Rockfall, Conn

MORE DATA? Circle 83, inside back cover

SOLVE YOUR DIFFICULT WORKHOLDING PROBLEMS WITH



SPECIAL CHUCKS



CONSULT CUSHMAN FOR THE ULTIMATE IN CHUCK ENGINEERING

The assembly print reproduced above is but one of many examples of special chucks designed and engineered to meet unusual workholding and machining requirements. Cushman Special Chucks are being used in many diverse industries enabling manufacturers to meet realistic production quotas, maintain close tolerances and achieve lowest cost on both short or long runs.

If you have a workholding problem, consult Cushman. Your problem may have already been solved.

THE CUSHMAN CHUCK COMPANY · HARTFORD 2, CONNECTICUT

Manufacturers of Air and Manually Operated Chucks, Power Wrenches, and Face Plate Jaws.

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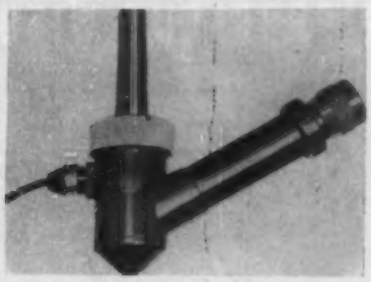


Jig Borer Microscope Contains Integral, Variable Light Source

This jig borer microscope has a low voltage light source built directly into the tube making it a completely self-contained unit. Light is regulated through a variable transformer and a beam splitter directs the light through the objective providing verticle surface illumination.

Total magnification is 25X by 2X objective with a 2⅜-in. working distance. The scope has a 12½X adjustable eyepiece with a hairline cross and a series of concentric circles for setting reference points and checking center distances between holes. Interchangeable and adjustable shanks, straight or tapered, are available to facilitate truing.

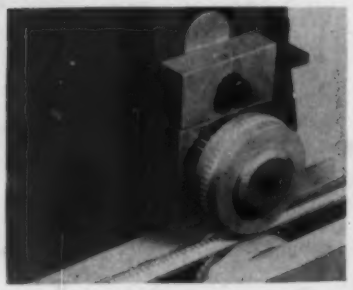
Opto-Metric Tools, Inc, New York 13, N.Y.

MORE DATA? Circle 84, inside back cover

reversal unit. The machine has a 5-in. quill, with an 8 hp motor, which makes it one of the most powerful of jig-borers. Table capacity has a maximum distance between hole centers of 45 x 25 in.

Dist by Continental Industries Co, Milwaukee 16, Wisc

MORE DATA? Circle 85, inside back cover



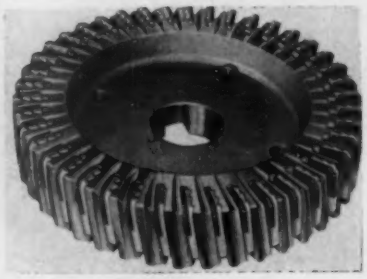
Motorized Marking Fixture Can Be Used For Continuous Work

Motorized G-R-D marking Fixtures are said to be practical for parts not customarily marked. The style H fixture (above) is for continuous marking along the full length of bar stock for screw machine processing. In this application, the marking die rotates at 58 rpm allowing impressions to be made as close as 1/32 in. or as far apart as 1/16 in.

Basic Components of the G-R-D fixtures: 1750 rpm, 1/3-hp motor; single revolution, solenoid operated clutch for non-continuous marking operations; a marking roll with any desirable symbols or lettering; T-handle for fine adjustment of marking depth; and a cradle or mandrel for holding parts to be marked.

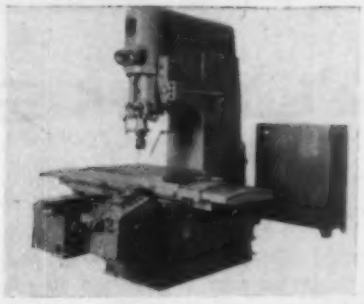
M E Cunningham Co, 1025 Chateau St, Pittsburgh 33, Pa

MORE DATA? Circle 86, inside back cover



SERIES 7100 RIGIDCUT FACE MILL is said to cut machining time for either roughing or finishing cast iron at high speeds and feeds because of the shape of the brazed carbide blade. Recommended for cuts up to 5/16 in., the cutters come with effective diameters from 6 to 20 in., in 1-in. increments—*Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich*

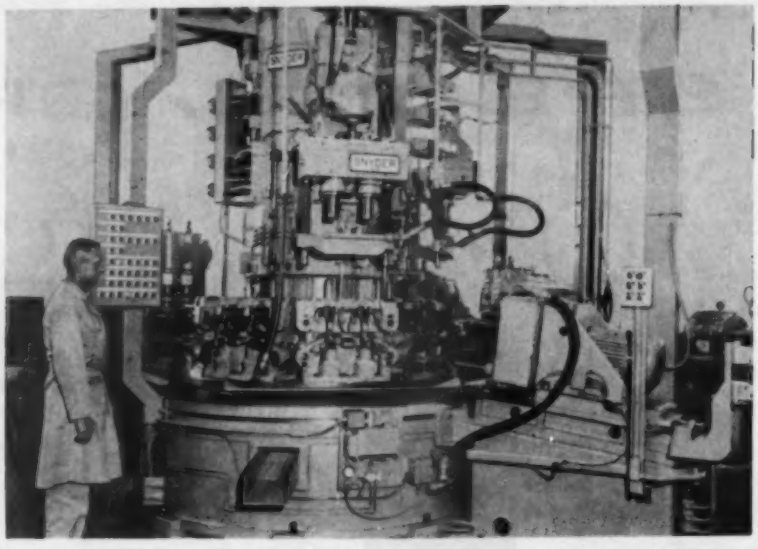
MORE DATA? Circle 87, inside back cover



German Optical Jig-Borer Has Accuracy up to 0.00005 in.

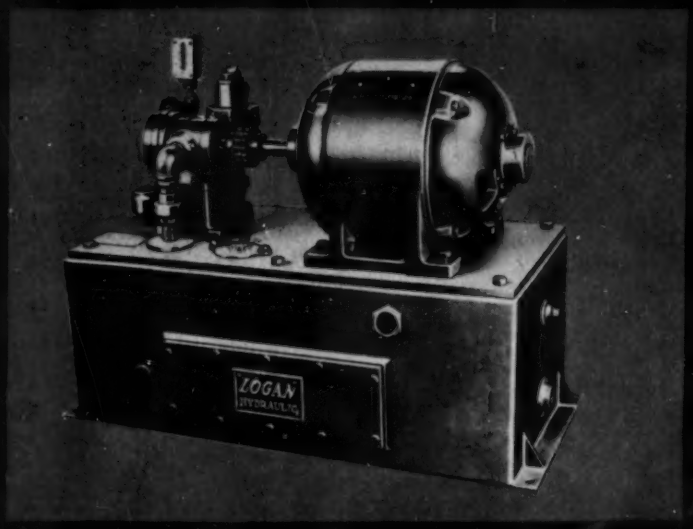
This Burkhardt (German) optical jig-borer Model HYOP 120 does not have a single gear or leadscrew. Instead, the manufacturer has developed a single lever control for fast positioning. With this single lever, the operator can engage rapid traverse, any milling feed, and creep feed of the coordinate table until his exact position shows up in the optical screen within an accuracy of 0.00005 in. No accumulative errors are said to occur.

Honing and internal grinding also can be done by an automatic quill



EIGHT-STATION CENTER COLUMN MACHINE mills, drills, counterbores, and taper reams forged steel automotive steering knuckles at 120 pc per hr. The machine is made up of standard building block components including standard base, index table, fluid drive index mechanism, five slide units mounted on wing bases around periphery of base, and three slide units mounted on column—*Snyder Corp, 3400 E Lafayette, Detroit 7, Mich*

MORE DATA? Circle 88, inside back cover



this power plant packs a Sunday Punch ...EVERY DAY IN THE YEAR!

This husky self-contained power unit combines true economy with tremendous efficiency to power cylinders, chucks, clamping devices and many other hydraulic machines.

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___100-2 MILL-TYPE AIR CYLS.	___200-2 ROTOCAST HYD. CYLS.
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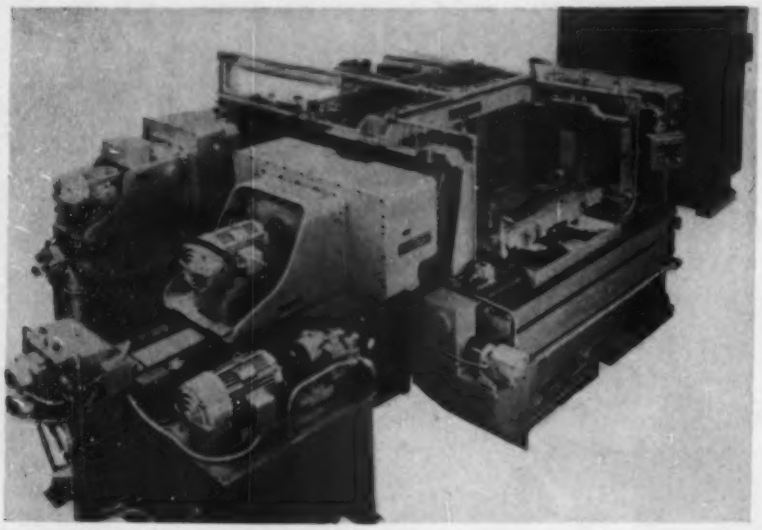
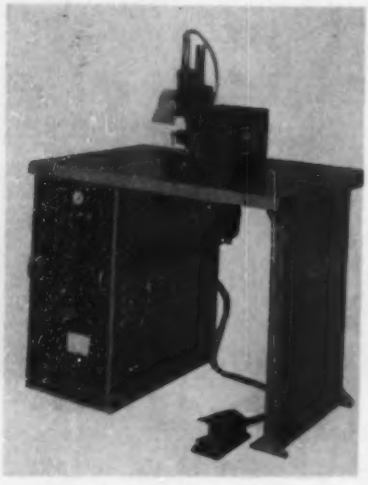


FIVE-WAY HORIZONTAL DRILLING AND TAPPING MACHINE, which handles either aluminum or cast-iron engine blocks, indexes only twice to perform 192 operations. The three-station transfer machine has an alternate set of pick-off gears on main drive of each spindle carrier to allow easy speed change for machining either aluminum or cast-iron crankcases—*The Foote-Burt Co, Cleveland 8, Ohio*

MORE DATA? Circle 89, inside back cover



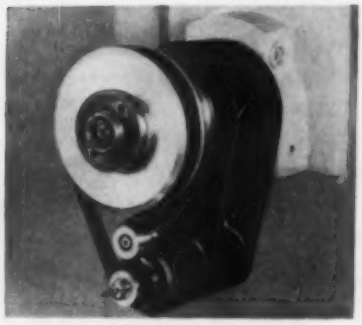
Bench Welding Equipment Handles Small Parts, Thin-Gage Materials

Sciaky SP.O bench welder, Model 369B, has standard equipment that includes a diaphragm head, table mounted, ac electrical and pneumatic controls, and welding transformer, available from 300 va to 2000 va. Components may be bought separately. Bench top is 30 in. deep, 42 in. long, and 32 in. from floor.

In addition to company's conventional ac control of C6H2 thratron contractor, synchronous weld timer, and heat control, a new and standard welder control is now included—a Pulse Firing Power System. The use of either affords a wide welding range of gage and material. With ac welding control, a relatively long weld time at a low energy level can be used. As an alternate (depending upon the application) with a Pulse Firing Power System, extremely high energy can be transmitted to the workpiece in about one millisecond. A low inertia diaphragm welding head, guided by two precision ball bushings, provides accurate electrode alignment and minmizes friction.

Sciaky Bros Inc, 4915 W 67 St, Chicago 38, Ill

MORE DATA? Circle 90, inside back cover



Compact Grinding Attachment Handles Hard-To-Reach Areas

Called "Diamond Speedgrind," this unit is easily attached to most surface grinders. Designed to reach areas inaccessible to conventional machines, the grinder is said to facilitate high precision surface grindng.

The body of the unit, made of a special alloy casting, has been designed to eliminate all unnecessary bulk, permitting the operator to get closer to the chuck. The attachment delivers 17,000 rpm at a 3,600-rpm drive spindle speed.

It comes with a choice of 3/32, 1/8 3/16 or 1/4-in. collet, or a mandrel for 1/4 or 3/8-in.-ID unmounted wheels. Special size and length mandrels are available. Price: $295 with a steel storage case and choice of collet or mandrel.

Speedline Sales Co, 12860 Fisk Ave, Warren Mich

MORE DATA? Circle 91, inside back cover

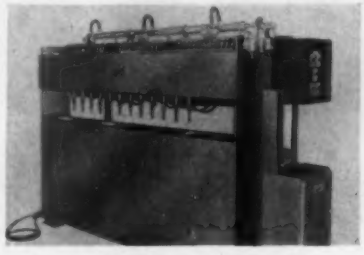
Solid State Reversing Drive Features Stepless Operation

A solid state reversing drive for DC shunt motors of up to three hp is said to reverse direction and rotation of the motor without using contractors or relays.

With no moving parts the static drive features a smooth and stepless operation with no dead-band around the zero speed.

ACF Electronics Div, ACF Industries, Inc, Riverdale, Md

MORE DATA? Circle 92, inside back cover



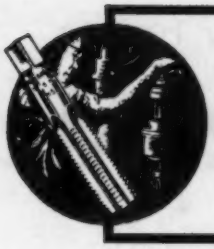
Multihead Spot Welder Features Cascade Firing

Available as a standard unit with 4, 8, or 12 heads, the welder incorporates cascade firing to prevent high power demand. All the heads come down at once; the transformers fire one after the other.

Each head has its own cylinder and is individually adjustable; each also has its own shut-off valve. There is a timer and an on-off switch for each transformer, allowing use of all or any combination of heads. Additional features include squeeze and hold timer to insure positive and consistent welds, and a two-stage foot switch arrangement.

Alphil Spot Welder Mfg Corp, 1058 Pacific St, Brooklyn 38, NY

MORE DATA? Circle 93, inside back cover



BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 8

Subject: Helpful Hints for Successful Tapping

The Drilled Hole:

The drilled hole should be of proper size; drilled straight and not out of round. For most applications, a thread height of 55% for smaller taps and 75% for larger taps will have more than sufficient strength. Excessive thread height may result in torn threads and high tap breakage. Tap drills used in malleable metals such as soft stainless steel, soft aluminum, copper, monel metal etc., should be the largest size permissible because these metals tend to flow to the crest of the minor diameter while being tapped. This results in a small minor diameter after the tapping operation. Where it is possible, bottoming holes should be recessed or drilled deeper than it is necessary to tap. When tapping a hole with a taper pipe tap, it is often helpful to taper ream before tapping. "Go" and "not go" cylindrical plug gages may be used to control the drilled hole size.

The Tapping Machine:

Use a tapping machine and tap holder suited for the work. Check the tapping machine spindle and holder for wear and alignment. If they are worn or out of line, oversize and bellmouth holes may result.

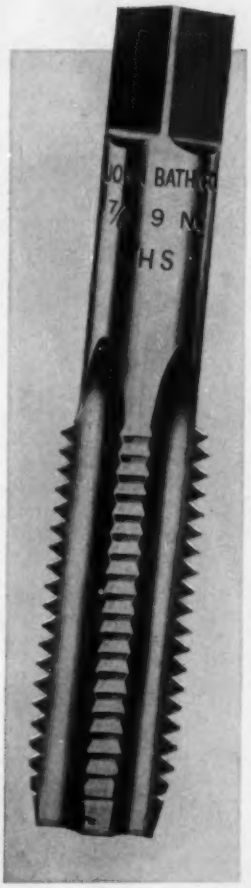
Lubrication:

The best lubricant for tapping depends on many variables such as the material to be tapped, the method of tapping and general conditions. The proper lubricant or cutting fluid can promote longer tap life, size control and higher tapping production. The correct lubricant can generally be determined by an oil company's representative who usually will make a survey and recommend the best lubricant for the specific tapping job.

Tapping Speeds:

There are many factors which affect proper tapping speeds, some of which are:

Material Factors: Thermo-conductivity of the material to be tapped and wall thickness as it affects heat dispersion; variations of carbon content of steel; hard spots in material; depth of hole to be tapped; thread height to be tapped.



Tap Factors: Major diameters, pitch and lead; style of tap; width of lands; amount of hook or rake; length of chamfer.

Mechanical Factors: Type of tapping machine and holder; condition of tapping machine; type of fixture; vertical or horizontal tapping (faster speeds for vertical tapping); method of feeding the tap; cutting fluid used and method of application. Generally the best speed for tapping is the highest speed that conditions permit.

Use a tap with the proper number of flutes, flute design, chamfer and pitch diameter for the job.

Avoid tapping a hole so deep that the flutes of the tap clog tight with chips. Tap breakage will result. When deep hole tapping is necessary, use one or more roughing taps and a finishing tap. Do not rough out a thread too close to the finished size. The finishing tap may bind in the thread and break; will rub instead of cut.

When starting to thread a hole, allow the tap to find its own lead. Do not attempt to force or retard the tap . . . this will cause a bellmouth hole.

Sharp taps are a must for successful tapping. Sharpen when necessary with the utmost care on one of the several types of machines on the market designed for this purpose. Do not sharpen taps by hand.

We have listed some of the most common tapping rules but there are many more depending upon the specific tapping job. Bath engineers will recommend proper taps and give tapping advice on application.

Clip and mail coupon NOW!

John Bath & Co., Inc. 22 Mann St., Worcester, Mass.

I would like to receive blueprints on the proper method of sharpening taps. Send to:

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City or Town _____ State _____

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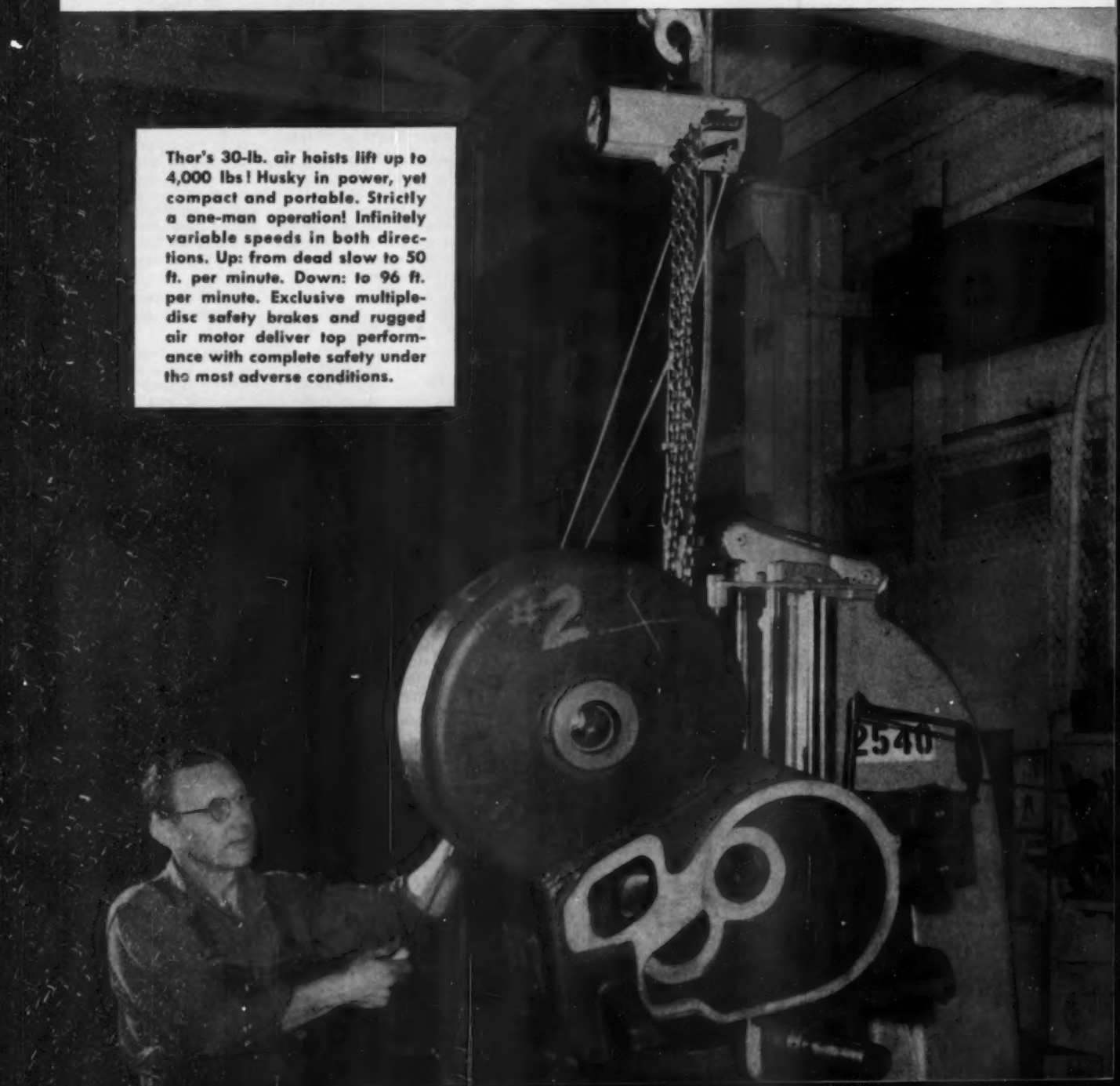
Lift up to 4000 pounds with new 30 lb. air hoists

THOR INDUSTRIAL AIR TOOLS



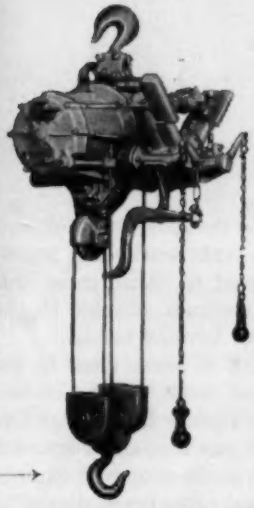
Thor's 30-lb. air hoists lift up to 4,000 lbs! Husky in power, yet compact and portable. Strictly a one-man operation! Infinitely variable speeds in both directions. Up: from dead slow to 50 ft. per minute. Down: to 96 ft. per minute. Exclusive multiple-disc safety brakes and rugged air motor deliver top performance with complete safety under the most adverse conditions.

There are as many ways to save your money on these two pages as there are Thor models of the tools shown. Every hoist, hammer, chipper, nut runner and grinder has been designed with only one purpose—reduce your costs by increasing production. That's been Thor's business now for 68 years. Make it your business to find out how Thor can help you. A nationwide network of factory experts and distributors are at your service. The Yellow Pages list them. Or write us at Thor Power Tool Co., Aurora, Ill.

THOR AIR IMPACT WRENCHES save time and money on nut running, screwdriving, reaming, tapping, applying and removing studs. Capacities from ¼" to 1¼".

THOR MULTIPLE AIR NUTSETTERS assure greater accuracy of torque control; definite savings over individual tool applications involving close patterns.

IT'S THOR POWER that does it! Thor air chipping hammers are famous for it. That, plus stay-on-the-job durability, economy and ease of operation. Complete selection of plate and spool valve chipping hammers; scaling hammers; riveting hammers.



LARGE CAPACITY HOISTS TO 3 TONS. Up to 90% faster. No jerking or vibrating. New, more powerful motors with mufflers. Thor has the hoist to complete it—any job faster and safer!

GET 50% MORE grinding power, 6 times quieter. Thor air grinders, available in forty models. Cup grinders, wire brushing machines and disc sanders.

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CIRCLE 271 READER SERVICE CARD

HOW TO EXPAND THE USE OF YOUR PRESS BRAKES

the blue book of press brake tooling

This new book is the most comprehensive treatise on press brake work—134 pages of ideas. It is offered to assist press brake users visualize methods suitable to their own bending and forming needs.

To develop any of these ideas to your particular type of work, on any make of press brake, the Tooling Division at Dreis & Krump offers you top, experienced designers and a large die shop well equipped to make the finest press brake dies of any type, any size, at lowest cost.

This book, Press Brake Dies, is available to any press brake user by request on company letterhead.

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CHICAGO DREIS & KRUMP

DREIS & KRUMP MANUFACTURING CO.
7434 S. Loomis Blvd., Chicago 36, Illinois

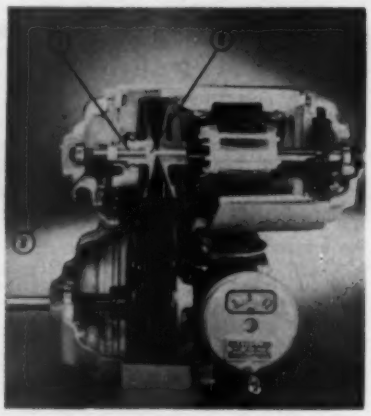
Heavy-Duty Tapping Unit Has 6-in. Max Spindle Travel

Model TU 1400 measures 32 in. in length, 10-15/16 in. in width, 22½ in. in height, and may be supplied with motors up to 10 hp. It can be used in any position, making it particularly suitable for multiple station arrangements on fixed and indexing tables. Built-in electrical relays permit automatic or manual cycling.

Each unit is provided with its own control panel and is capable of 30 reversals per minute. It is equipped with an oil reservoir tank and a lubricating pump. All castings, including motor housing, are of aluminum alloy.

Johnson Drill Head Co, Rockford, Ill

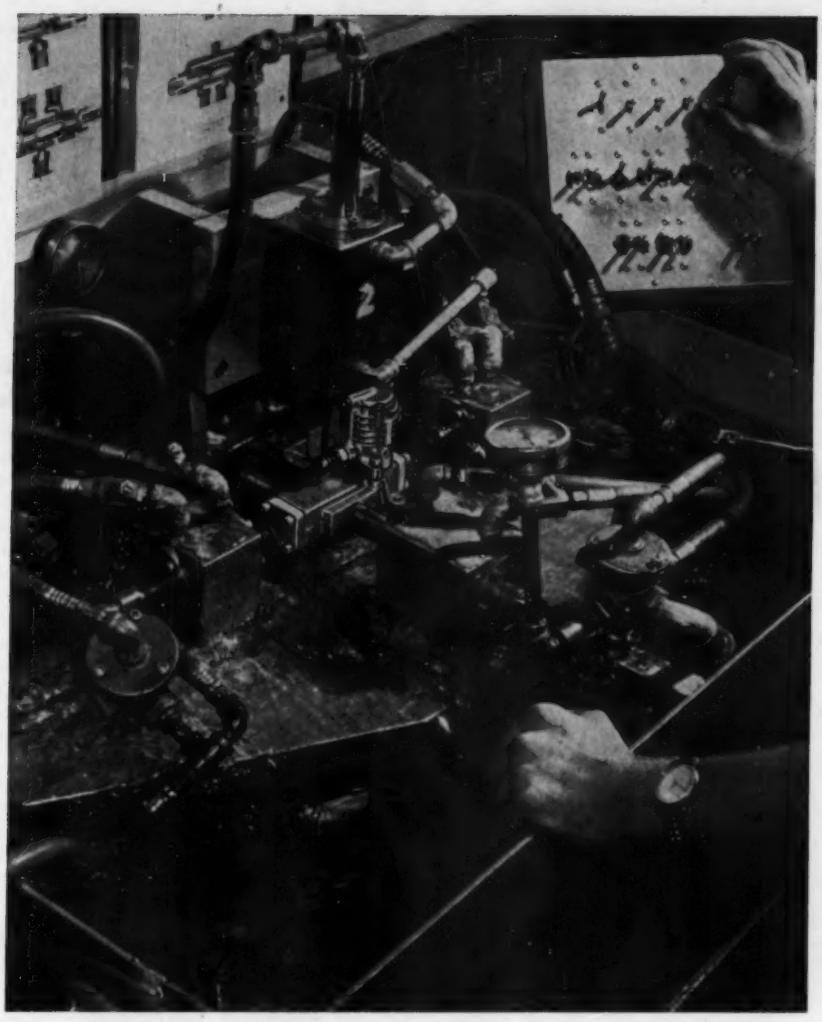
MORE DATA? Circle 100, inside back cover



VARIABLE SPEED DRIVE eliminates three major lubrication spots as shown: (1) Keys are made from tough elastic material to eliminate key and keyway wear; (2) Wear-resistant non-metallic bushings require no lubrication; (3) Shaft surfaces are corrosion-proof and require no lubrication. Drives are produced in ¼ to 25 hp with output speeds from 4606 to 0.4 rpm in speed variations up to 10:1—*Dept B-1, Sterling Electric Motors, Inc, 5401 Telegraph Rd, Los Angeles 22, Calif*

MORE DATA? Circle 101, inside back cover

test every valve?



Valvair does! How else can any manufacturer be sure that every valve he ships to a customer will function properly, from the first cycle on?

Each Valvair valve is cycled and re-cycled under water, at 30 to 50% above its rated pressure, to be certain that it meets Valvair's rigorous performance specifications. And, this final operating test is just one of the countless rigid quality control inspections each part of every valve must pass during its manufacture. In fact, one out of every twelve Valvair production men is a full-time inspector. Parts are scrutinized in process, as well as just prior to assembly. The most modern types of equipment, including optical comparators, surface finish indicators, optical and air gaging units, super magnifiers and precision gages, are used by the inspection team to assure Valvair's reputation for outstanding quality.

Specify Valvair components for the equipment you design, build or operate, to maintain your reputation for quality. For all the facts, write for Bulletin 59-SK, or call your nearby Bellows-Valvair Field Office. Address Bellows-Valvair, Akron 9, Ohio, Dept. AM-361

Bellows-Valvair

AKRON 9, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

8171

Eliminate "high-cost specials" by standardizing on

AMERICAN STOCK GEARS

Investigate and you'll probably find that instead of having to go to the added time and expense of ordering special gears, that your needs can be filled from the American line.

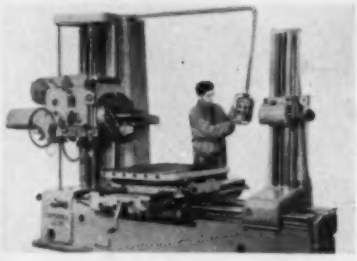
American is a 'complete' stock gear line. Manufactured by Perfection — a veteran of over 30 years in the gear business — these gears are made to the most precise standards, from the highest quality materials. This popular line includes brass, bronze, steel, semi-steel, cast iron, and non-metallic gears in a range of 48 to 3 diametral pitch.

You'll save time and money . . . save on inventory . . . simplify purchasing and have less lost production time by procuring your stock gear needs from your nearby distributor of American Stock Gears.

Ask for FREE copy of American Stock Gear Catalog No. 360 containing detailed information and engineering data.

AMERICAN STOCK GEAR division

Perfection Gear Co., Harvey, Illinois



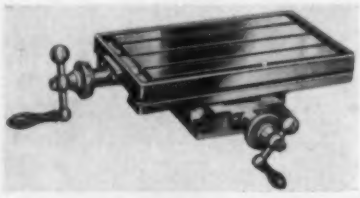
Supermill Horizontal Boring Mill Has Airflo Suspension System

Model A176, a 3-in.-bar horizontal boring, milling, drilling, and turning machine, is equipped with the Airflo suspension system that eliminates metal-to-metal contact on the table movement. Both the longitudinal and cross travel of the saddle and table are completely supported by an infinitesimal film of air supplied by a built-in air-oil compressor. The volume of air required is minute and the pressure extremely low, measured in a fraction of 0.0001 in. Both table and saddle riding on lubrication of compressed air and oil results in smoothest possible traverse both for feed and rapid return.

In addition to the suspension system, the machine now has complete square D pendant controls and hydraulic clamping of head, table, and outboard, plus optical measuring controls.

S & S Machinery Co, 140 53rd St, Brooklyn 32, NY

MORE DATA? Circle 102, inside back cover



Milling Table Accessory Offered for Drillpress

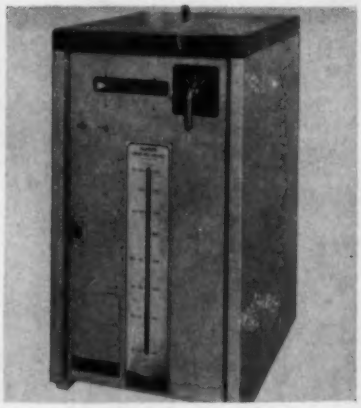
Compound milling table accessory is designed for operations involving end mills up to ½-in. dia and jig boring requiring medium accuracy. When the frequency of jobs and size of the tools demand, Boice-Crane's geared-head drillpresses can be fitted with a special type of milling spindle with threaded nose and screw-on collar.

The milling table has accurately ground work surface size 22½ x 9½ in., fitted with two T-slots, perimeter coolant trough, and a third T-slot in the front vertical table surface. Lon-

gitudinal feed is 14¾ in. crossfeed is 6½ in. The longitudinal and cross-slide saddles are scraped, fitting with both gib adjustments and adjustable stops. Overall height is 4-5/16 in. The milling table can be used interchangeably on company's 18, 24, and the new 25½-in. geared-head drill-presses and adapts to any press with table-knee bored 2⅜ in.

Boice-Crane Co, 935 W Central Ave, Toledo 6, Ohio

MORE DATA? Circle 103, inside back cover



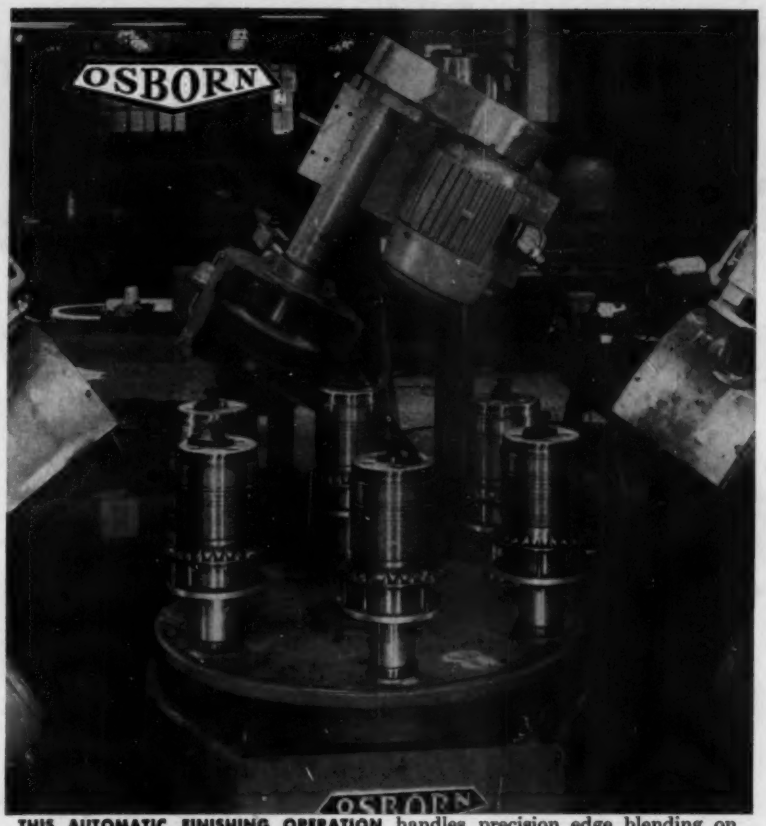
TIG Welding Power Supply Features Balanced Wave

New type of balanced wave power supply is designed specifically for high performance inert gas welding with non-consumable electrode. Design provides a capacitor bank in the secondary circuit and employs non-saturable reactor and transformer design to assure balanced electron flow between electrode and work-piece. Full electron flow in both directions greatly improves the removal of surface oxides on aluminum welding and reduces arc fluctuation and sputter to provide dense, clean welds of excellent appearance, manufacturer states.

Built-in high frequency generator provides arc ignition without contact between electrode and work piece. Infinitely variable motorized current control is provided throughout three overlapping switch ranges: low, 28-58 amp; medium, 53-175; high, 165-400 on 150-v scale. Two models are available. Model BW400-AC delivers ac only, with selectable open circuit voltages of 100 and 150. Model BW400-AC/DC includes a heavy-duty rectifier bank and delivers either ac or dc, with 150-v open circuit on ac and 80-v on dc.

Glenn Pacific Corp, 703 37th Ave, Oakland 1, Calif

MORE DATA? Circle 104, inside back cover



THIS AUTOMATIC FINISHING OPERATION handles precision edge blending on aircraft engine cylinder barrels. Setup consists of an Osborn 6-station index table and three finishing heads equipped with Osborn Fascut® Brushes with deburring compound. Heads No. 1 and 3 each brush one minute clockwise and ccw to put .020" blend on edges of mounting holes. Head No. 2 brushes 1½ minutes cw and ccw to put .010" blend on top edge and O.D. thread ends.

EDGE BLENDING cylinders

done 566% faster with OSBORN power brushing

Here's an aircraft manufacturer with a problem: specifications for these reciprocating engine cylinder barrels called for precision tolerances. Hand finishing rate: 3 parts an hour . . . too slow . . . too costly.

Today, an automatic Osborn Metal Finishing Machine handles the work . . . *power brushing* the parts rapidly, uniformly, economically. Rate: 20 an hour . . . *566% faster with exceptional quality control.*

It's another case-in-point of today's Osborn power brushes and brushing methods at work throughout industry solving tough metal finishing problems. An **O**sborn **B**rushing **A**nalysis—made in your plant now at no obligation—can cut costs on *your* deburring, cleaning, polishing and precision blending operations. Write or call *The Osborn Manufacturing Company, Dept. C-109, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

OSBORN

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery

Abrasion resistance approximately 25% better than carbon steel

CHEMICAL ANALYSIS AND PHYSICAL PROPERTIES

YOLOY GRADE A

Ladle Chemical Analysis, *percent*

Carbon	.25 max.	Sulphur	.050 max.
Manganese	1.60 max.	Silicon	.30 max.
Phosphorous	.040 max.	Copper	Optional

Minimum Physical Properties

THICKNESS	To 5/16"	Over 5/16" to 3/8" incl.	Over 3/8" to 1/2" incl.
Yield point, psi	50,000	47,000	45,000
Tensile strength, psi	70,000	70,000	70,000
Elongation in 2", %	20.0	20.0	20.0

YOLOY GRADE B

Ladle Chemical Analysis, *percent*

Carbon	.23 max.	Sulphur	.050 max.
Manganese	1.40 max.	Silicon	.30 max.
Phosphorous	.040 max.	Copper	.20 min.

Minimum Physical Properties

THICKNESS	To 1/2" incl.	Over 1/2" to 1½" incl.
Yield point, psi	45,000	42,000
Tensile strength, psi	70,000	65,000
Elongated in 2", %	22.0	22.0

ADDITIONAL TYPICAL PROPERTIES OF YOLOY GRADE B

Ultimate compressive strength.....equals tensile strength
Ultimate shearing strength..equal to ¾ tensile strength
Modulus of elasticity, psi.....28,000,000/30,000,000
Endurance limit (normalized), psi.....40,000
Charpy impact, keyhole notch
(As rolled room temperature, av. ft. lbs.).....30
Coefficient of expansion, per degree F.
70° to 200° F..... .0000063

FABRICATING PRACTICE FOR COLD FORMING

Thickness of product	Recommended minimum inside Radii	
	Yoloy Grade A	Yoloy Grade B
1/16" to 1/4" incl.	2-½ x thickness	2 x thickness.
Over 1/4" to 1/2" incl.	3-½ x thickness	3 x thickness.

Hot forming is recommended for thicknesses over 1/2"

WELDING Yoloy M may be butt welded satisfactorily using the low hydrogen electrode without preheat. Similar results were obtained on fillet welds. The parent metal failed before the weldments.

YOLOY

high strength steel outlasts ordinary steels—makes tough equipment tougher

Youngstown's Yoloy M is a special steel for punishing jobs. It is a giant shovel's bucket teeth, bulldozer blades, tracks for cats. A steel to stand up under weather and wear. Yet Yoloy M costs less in the long run because it outlasts others.

Yoloy M is a low carbon open hearth steel alloyed with precise amounts of copper and manganese. It resists atmospheric corrosion up to 2 times better than carbon steels—is up to 40% stronger. You replace weight with strength. You get a tougher, harder steel to keep heavy equipment working longer under any and all conditions.

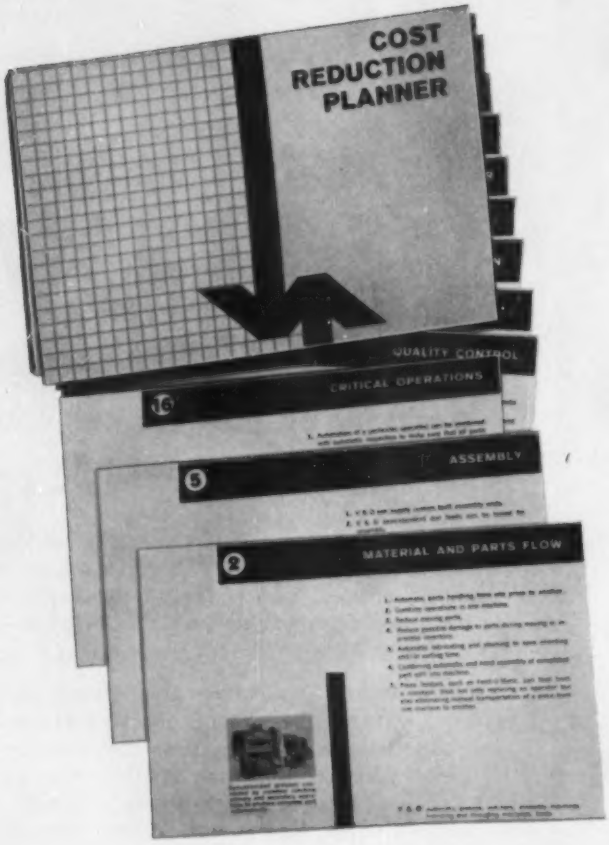
Youngstown makes Yoloy M in two different types to suit your specifications: Grade A and Grade B. Yoloy Grade A is recommended for light plate and intermediate thickness applications where only moderate forming and simple welding are involved. Yoloy Grade B is for special applications involving intricate forming and greater resistance to shock and impact. Both are available in hot rolled bars, bar shapes, plates, sheets and strip.

Specify high quality Youngstown Yoloy M when you want rugged, efficient higher strength steel.

Youngstown — growing force in steel

For complete information about Yoloy Steel, write: Department 3-A.
The Youngstown Sheet and Tube Company, Youngstown, Ohio

CIRCLE 277 READER SERVICE CARD



Cost reduction in small parts production is our business. Let us discuss the 16 areas in which V & O presses, press tooling, dial feeds, and special units can be of help. Just a few minutes going over the above Cost Reduction Planner with one of our men could lead to dramatic savings. Ask to see a representative by contacting Emhart Manufacturing Company, Hudson Division, Hudson, N. Y. It could be one of the most important requests you'll make this year.

EMHART

COST REDUCTION IN SMALL PARTS PRODUCTION

Ten minutes with an Emhart rep may uncover a hot new cost reduction plan in one or more of these areas:

1 PRODUCT DESIGN
2 MATERIAL AND PARTS FLOW
3 PACKAGING
4 FABRICATION
5 ASSEMBLY
6 DIRECT LABOR
7 INDIRECT LABOR
8 METHODS SIMPLIFICATION (PEOPLE)
9 METHODS SIMPLIFICATION (MACHINES)
10 QUALITY CONTROL
11 IN-PROCESS INVENTORY
12 MAINTENANCE
13 FLOOR SPACE
14 SPARE PARTS INVENTORY (CUSTOMER)
15 SPARE PARTS INVENTORY (V & O MACHINES)
16 CRITICAL OPERATIONS

V & O AUTOMATIC PRESSES AND FEEDS

Portable Hydraulic Pump Unit Designed as Drilling Accessory

Self-contained unit that wheels from one machine to another supplies coolant for gun drilling on turret lathes, drillpresses, and boring mills. It employs a balanced vane-type positive-displacement pump mounted inside a metal cabinet with integral 40-gal capacity coolant tank. A 5-hp motor supplies 10 gpm at 1000 psi.

Operator controls the pumping unit through an instrument panel or the unit can be automated to synchronize with drilling operations on automatic chuckers and similar equipment. Model can be used with any gun-drilling coolant having a viscosity of 125 to 250 SSU at 100 F.

Ward-Riddle Co, Ravenna, Ohio

MORE DATA? Circle 105, inside back cover

Metal Coating Gives Protection Against Acid, Alkali, Exposure

Full protection from acids, alkalis, and outdoor exposure for aluminum, other non-ferrous metals, and stainless steel is promised with a new all-polymer coating called Perma-Cote 61. It is said to be the only product to meet the Aluminum Window Manufacturers Assn specifications for acid and mortar resistance after only one coat.

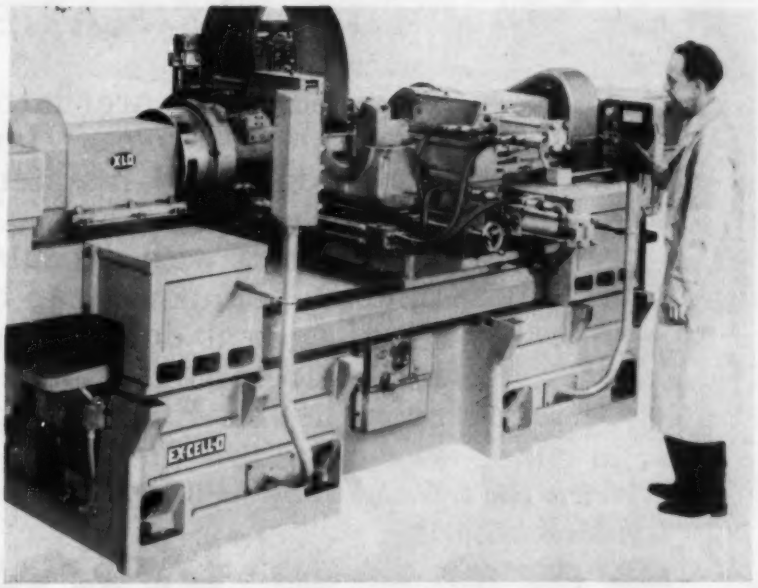
Perma-Cote 61 is a colorless, nonyellowing coating which forms a tough, glossy film that will not discolor when exposed to ultraviolet rays. It is said to have excellent adhesive qualities and can be applied by dip, brush, or spray. The coating dries tack-free in two to three minutes at room temps and 50% relative humidity.

The company sees Perma-Cote 61 as the answer to the etching problem caused by highly alkaline mortar used in construction and muriatic acid used in post-installation clean up.

Said to provide long-term protection, Perma-Cote 61 comes in 55-gal drums with smaller sizes available to fabricators and construction companies for demonstrations and tests.

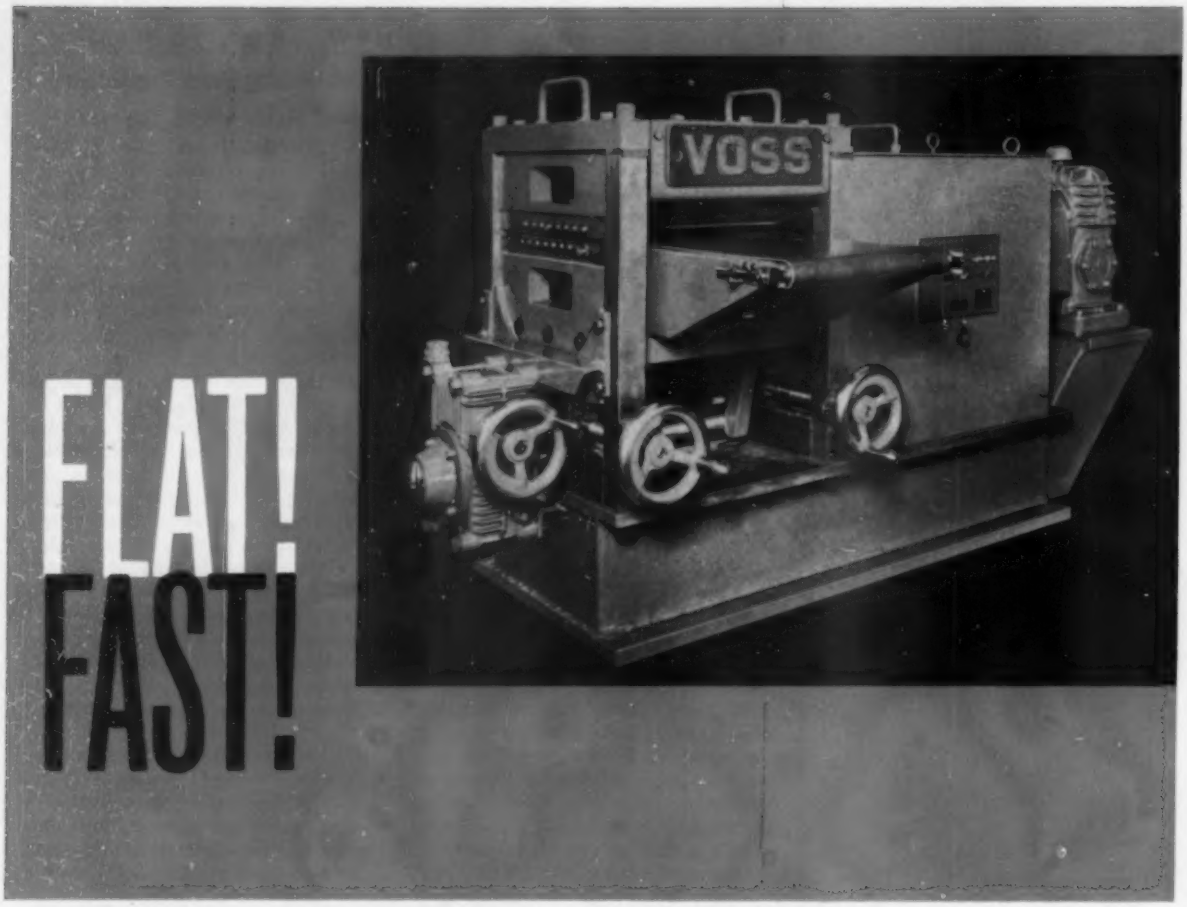
Service Products Div, S C Johnson & Son, Inc, Racine, Wis

MORE DATA? Circle 106, inside back cover



MODEL 772 PRECISION BORING MACHINE produces 47 different sizes and configurations of heavy-duty pillow-blocks. Two standard heavy-duty precision spindles carry a minimum number of interchangeable boring quills—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich*

MORE DATA? Circle 107, inside back cover



THAT'S THE STORY OF THE NEW VOSS STAMPED PARTS-FLATTENER

Stamped parts are flattened to .005 of dead flatness *in one pass!* Hand or automatic feed. Heavy duty, low maintenance. Takes no more space than your desk. Can be engineered to flatten parts with irregular surfaces. Savings in time and manpower can be enormous. Low cost for the job it does. If you're looking for cost reduction in your stamped parts operation, call or write Voss Engineering Company.

We'll be glad to arrange a demonstration with your parts, without obligation.

Voss ENGINEERING CO.

7301 Penn Ave. Pittsburgh 8, Pa. Churchill 2-4422

(Makers of the Voss Precision Roller Leveler)

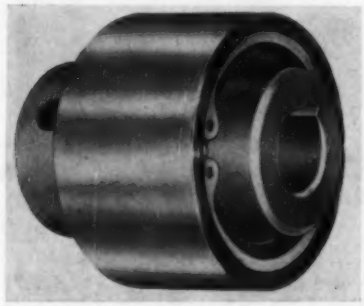
Sand Blast Machine Marks And Stencils Automatically

Model 173 (re-designed version of Model 162) is a small, compact unit for marking metal, glass, and plastic components. In operation, the parts to be etched are placed in a work locating fixture on top of the cabinet. Vizual observation and location of the workpiece is unnecessary.

The sand blast nozzle is located within the cabinet and fixed in a vertical position. Flow of abrasive is controlled by a pedal. Stencil work up to ¼ in. round or ⅞ in. square can be handled by a single nozzle; if larger areas are to be marked, the number of nozzles needed is increased. Cabinet measures 37 in. wide by 19 in. deep by 31 in. high.

Pressure Blast Mfg Co, 27 Pleasant St, Manchester, Conn

MORE DATA? Circle 109, inside back cover



OVERLOAD PROTECTOR COUPLING, Torq-Tender, fits motor and machine shafts from ⅜ to 1½ in. dia, and can be ordered preset to disengage at any torque setting from ½ to 60-ft-lb. It can be used either in direct drive or in attachment with sprocket, gear, or pulley; it is warranted for 1 million disconnect-reconnect cycles—*Helland Inc, Navarre, Minn*

MORE DATA? Circle 110, inside back cover

final touch-up
fast and clean!

fine-line separations between colors made sharp with masking

TAPES FROM 3M

The final touch of quality for Evinrude outboard motors goes on easily and quickly with the help of masking tapes from 3M. After motor shrouds are covered with flexible shields and sprayed, separation between colors is ragged. Application of "Scotch" Brand Masking Tape and a quick final touch-up spray makes the separation sharp and clean.

TRY THIS METHOD. See how it speeds finishing operations and improves results. Ask your 3M Representative or nearest "Scotch" Brand Tape Distributor for a demonstration, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. 1BA-31.

SCOTCH BRAND
tapes for industry

Minnesota Mining and Manufacturing Company
...where research is the key to tomorrow

3M COMPANY

"Scotch" is a registered trademark of 3M Co., St. Paul 6, Minn.

In industrial wrenches...

check the price tag— check the real cost, too!

Hand tools with the lowest price tag often are the most expensive. Before you buy, consider tool life, speed of delivery, vendor's tool knowledge, worker productivity. Consider tool quality and all it implies. For example, SNAP-ON® tools are made from specially selected alloy steels that provide toughness and durability—factors that permit lightweight design. A man can work faster, easier, get more done with these tools than with clumsy heavyweights.

Forging, machining and heat-treating operations are precision-controlled. A SNAP-ON wrench fits snugly, surely — lets a man pour on the muscle power with confidence. SNAP-ON tools cost less in the long run. They stay on the job long after price-line merchandise hits the junk heap.

Delivery speed is important, too, particularly on assembly line tools. SNAP-ON maintains fully stocked regional and branch warehouses throughout the U.S. and Canada. SNAP-ON customers get immediate attention on emergency calls.

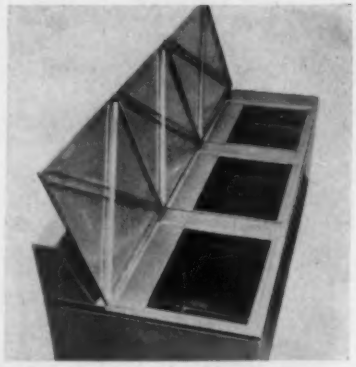
Finally, you can't put a price tag on tool knowledge and experience. SNAP-ON sales engineers are qualified to give advice on proper tool selection, plan decentralized tool cribs, analyze tool needs for maintenance and overhaul. They also refer ideas on special tools to SNAP-ON design engineers.

By every tool measure, SNAP-ON gives you your money's worth — and then some. Your nearest SNAP-ON representative would welcome the opportunity to prove this. Call him or write us now for new 180-page industrial catalog.

FOR ALL INDUSTRY

SNAP-ON TOOLS

8025-C 28th AVENUE • KENOSHA, WISCONSIN



Three-Stage Cascade Rinse Unit Introduced by Bendix

Designed to complement manufacturer's line of sonic energy cleaning systems, this unit has three stations. Rinse solution is pumped into the first station over-flowing into the second, and then into the third station where it is drained for rejuvenation and recirculation.

Parts being rinsed are submerged in chamber three followed by submersion in two, and subsequently in chamber one, the cleanest of the three. After rinsing, parts are dried in a forced air dryer. Cascade units are available with three 14 x 20-in. or three 18 x 25-in. chambers.

Bendix Corp, Pioneer-Central Div, Davenport, Iowa

MORE DATA? Circle 111, inside back cover

Controlled Atmosphere Box Furnace Added to Ipsen Line

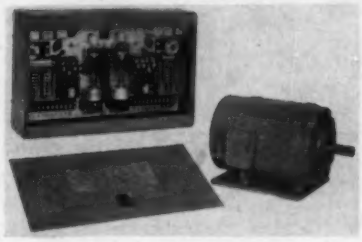
Furnaces are available as gas-fired, oil-fired, or electrically heated units. Operating temperatures of 2400 F can be maintained in the smaller models and larger ones are capable of temperatures to 2250 F. Excellent temperature uniformiy is maintained since the charge is headed by 100% forced convection.

Features include higher temperatures because there is no alloy inside the furnace; protected atmosphere is circulated by a ceramic fan capable of driving the atmosphere at a speed of 2500 fpm; heating is accomplished by Ipsen super alloyed ceramic heat-

ing tubes that are impervious to high carbon and high hydrogen atmospheres as well as resistant to extreme changes of either heating or cooling. Furnaces can be manually charged or can be used with mechanized loaders and unloaders for production line heat treating operations.

Ipsen Industries Inc, PO Box 500, Rockford, Ill

MORE DATA? Circle 112, inside back cover



Electronic Adjustable Speed Drive Available to 7½ hp Maximum

Two more sizes in integral horsepower ratings have been added to the line of Series 25 electronic adjustable speed drives. Size 3 drives are rated at 3 hp max and Size 4 at 7½. Sizes 1 and 2 previously offered covered ratings to ¾ hp.

Series 25 drives consist of dc motors powered by two thyratrons in a full wave circuit. Speed ranges up to 100:1 are attainable. All Size 3 and 4 drives include reversing and dynamic braking. Systems may be purchased with or without enclosure, and user may furnish his own operating controls if desired. Standard input voltage is 230 v, 60 c, single phase.

Cleveland Machine Controls Inc, 1155 Brookpark Rd, Cleveland 9, Ohio

MORE DATA? Circle 113, inside back cover

FEEDALL 110 CONTROL SWITCH maintains desired flow rate through pressure of moving work pieces. Measuring 1 7/16 x 1 13/16 x 3 7/8 in., the switch operates on 110 or 220 v, and weighs 12 oz—*Feedall, Inc, 38399 Pelton Rd, Willoughby, Ohio*

MORE DATA? Circle 114, inside back cover

trim the cost of trim painting!

fast and fancy finishing when you use masking

TAPES FROM 3M

The Harley-Davidson Motor Co. chooses masking tapes from 3M to speed much of the decorative trim painting on their products. Curved surfaces . . . complicated designs . . . the need for perfect results make "Scotch" Brand Masking Tapes especially desirable. These tapes from 3M conform easily . . . stick at a touch . . . remove cleanly and easily . . . leave no adhesive residue.

TRY THIS METHOD. See how it speeds finishing operations and improves results. Ask your 3M Representative or nearest "Scotch" Brand Tape Distributor for a demonstration, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. 1BA-31.

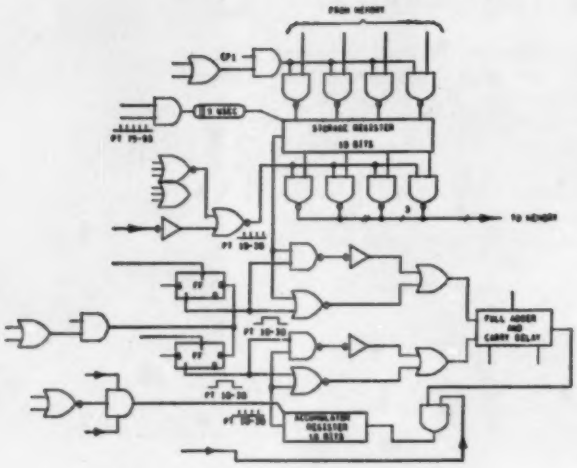
SCOTCH BRAND
tapes for industry

Minnesota Mining and Manufacturing Company
. . . where research is the key to tomorrow

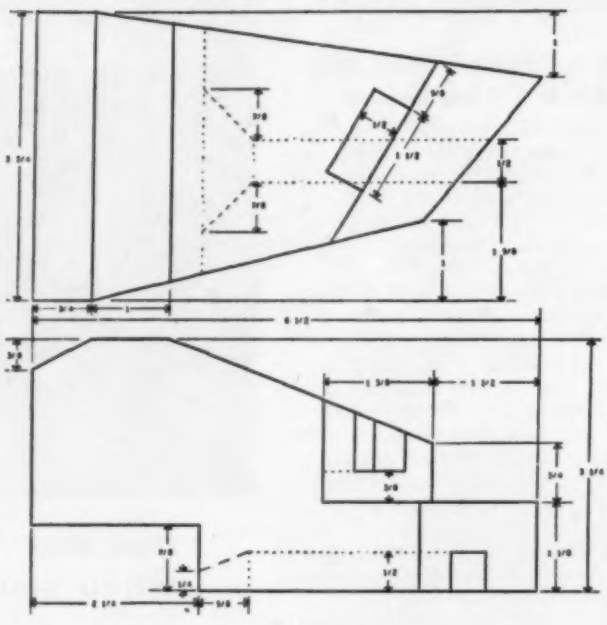
3M COMPANY

"Scotch" is a registered trademark of 3M Co., St. Paul 6, Minn.

NOW! Automatic drafting like this from your computer in less than 1 second!



Actual drawings produced by the S-C 4020 High-Speed Microfilm Recorder

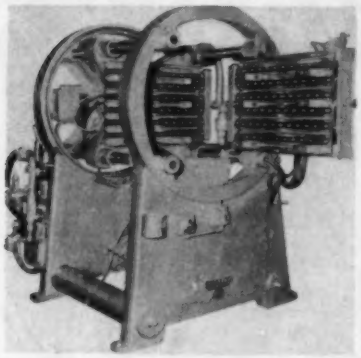


The S-C 4020

Instantaneous mechanical drawing is now a reality, with the Stromberg-Carlson S-C 4020 High-Speed Microfilm Recorder. Automatic drafting can cut weeks from design time, saving invaluable engineering man-hours. Here's how it works:

A computer is programmed with the contours and specifications of the part to be designed, using APT (Automatically Programmed Tool) language. The computer operates the S-C 4020 Recorder which makes multi-view mechanical drawings of the part in a fraction of a second. After the drawings have been checked, output of the computer can be used to operate a numerical control tool and produce the part. Capabilities of the S-C 4020 include recording data on microfilm at 17,500 points per second, plotting graphs on microfilm at 12,500 points per second, recording complex logic circuit drawings, tabular printing and forms projection. Write for more details to Stromberg-Carlson-San Diego, Dept. B-24, P. O. Box 2449, San Diego 12, California.

STROMBERG-CARLSON-SAN DIEGO
A DIVISION OF **GENERAL DYNAMICS CORPORATION**



Shell Core Blower Has Each Step Automatically Timer-Controlled

Model U-180-M shell core blower has many automatic features, including power roll-over. Only a few manual operations, such as core box opening and closing, are required in a cycle. Each step in sequence is automatically controlled by pre-set timers to give consistent quality of shell core production.

The unit has all the basic features of its fully automatic counterpart, the Model U-180, but costs considerably less, according to the company.

Occupying an area only 8 ft square, the machine is offered for either gas or electric core box heating, and accommodates core boxes up to 27 x 20 in. with a max depth of 15 in. The integral sand hopper will hold 150 lb of sand.

One man can operate more than one machine, and therefore both right and left hand models are available. All auxiliary attachments common to the automatic model are available.

Shalco Div, The National Acme Co, 170 E 131 St, Cleveland 8, Ohio

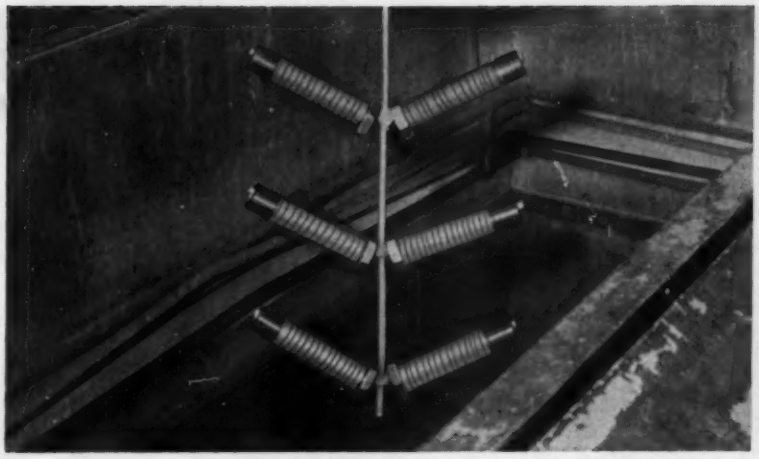
MORE DATA? Circle 115, inside back cover

Miniature Flexible Coupling Line Includes 12 New Models, Sizes

Dial line has been expanded to include 12 new models and/or sizes including a new ⅝-in.-OD coupling in both pancake and split-hub types. Sizes now range from ⅝-in.-OD to 1-5/16-in.-OD and bore sizes from 0.0937 to 0.6875 in. These couplings are rated to transmit 15 to 40 in.-lb of torque at high speeds. They absorb angular misalignment up to 7½°, lateral misalignment up to 0.015 in., and axial movement up to 0.060 in. in a single unit. Finishes are to MIL specs.

Dial Products Co, 19 Cottage St, Bayonne, NJ

MORE DATA? Circle 116, inside back cover



mask simple shapes or complex contours

plating solutions can't creep under these tight-sticking

TAPES FROM 3M

Stop-off masking and rack wrapping are fast, easy, sure when you choose tapes from 3M for the job. "Scotch" Brand Electroplating Tape No. 470, developed especially for plating applications, is strong, conformable and has a backing that resists effects of most solutions.

Other electroplating tapes too: one that's extremely thin, tough, transparent; another backed with lead foil for use where "thieving" action is required.

TRY THIS METHOD. Ask your 3M Representative or nearest "Scotch" Brand Tape Distributor for a demonstration, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. IBK-31.

SCOTCH BRAND tapes for industry

Minnesota Mining and Manufacturing Company

...where research is the key to tomorrow

3M COMPANY

"Scotch" is a registered trademark of 3M Co., St. Paul 6, Minn.

WALKER CERAMAX

TURNING

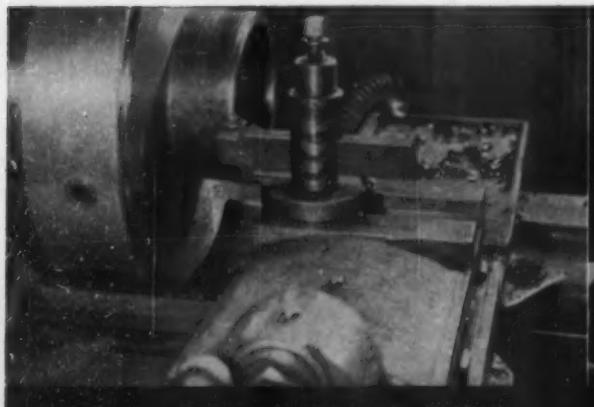
Walker, for the first time in machine tool history, offers safe magnetic holding for lathes. Ceramic magnets in Walker Rotary CERAMAX chucks are not subject to electrical power failure and have three times greater coercive force than ordinary Alnico magnets. With uniform holding power over the entire face of the chuck, safe, accurate turning, facing or trepanning is accomplished in a single set-up.

For dependable, trouble free operation specify Walker CERAMAX Chucks.

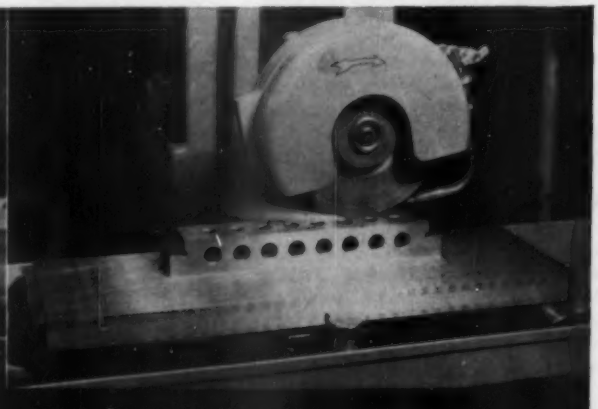
GRINDING

Walker CERAMAX chucks provide all the holding power needed for standard grinding operations and with fine pole divisions are ideal for thin, small work as well as large, heavy pieces. All-steel top plate minimizes redressing to reduce non-productive machine time. Ceramic magnets retain magnetism permanently, eliminate constant recharging.

O.S. Walker Co., Inc.
ROCKDALE ST. • WORCESTER 6, MASS.
Original Designers and Builders of Magnetic Chucks

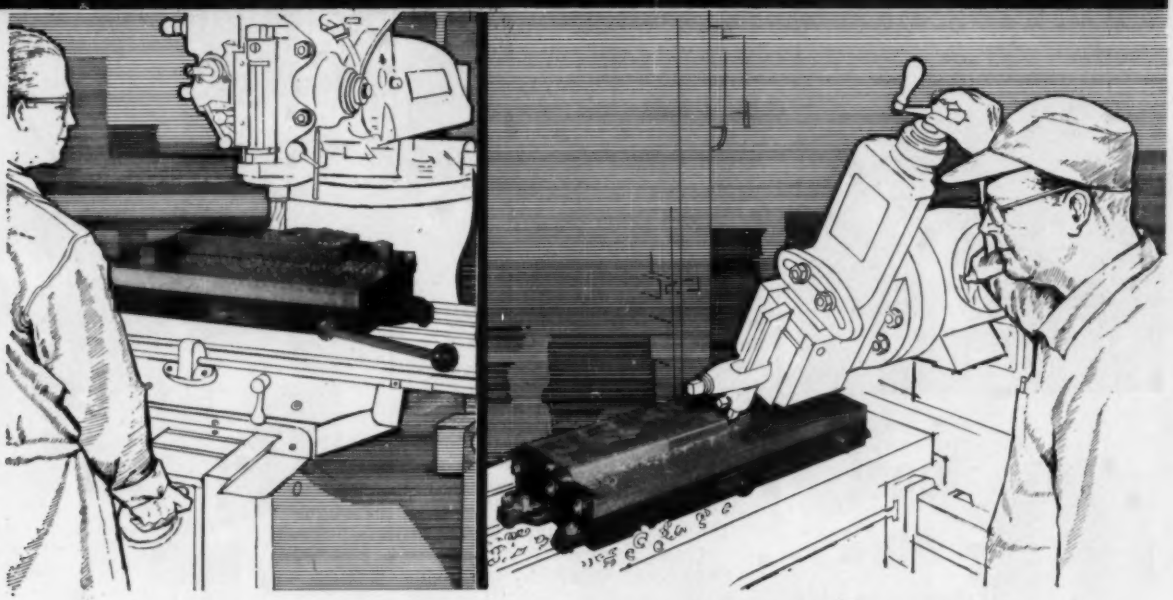


Turning a steel sleeve with a Walker Ceramax Chuck



Precision grinding on a Walker CERAMAX chuck

MAGNETIC CHUCKS



MILLING

Walker CERAMAX Chucks eliminate tedious clamping in many milling operations. Only an auxiliary end stop to take the thrust on the table is needed for extra heavy cuts. Power-packed ceramic magnets individually magnetize each pole. Focused flux keeps the magnetic force down near the top plate and away from the spindle. Controlled magnetism from alternating north and south poles actually exerts a demagnetizing influence on the cutter. Tools remain chip-free.

SHAPING

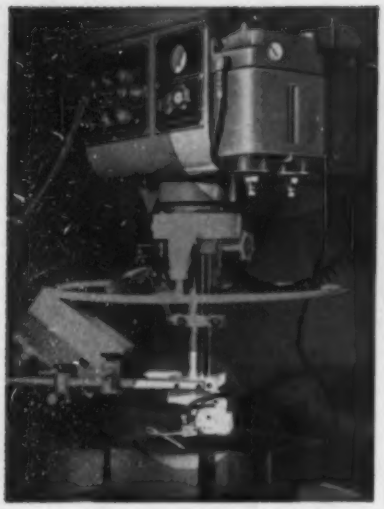
Walker CERAMAX Chucks reduce machine down time and speed production in many shaping, profiling, broaching and planing operations. Extraordinary resistance to sliding force results from coercive force exerted by the fine pole divisions of permanent ceramic magnet chucks.

Check your plant for the many cost saving applications possible with Walker CERAMAX chucks.

O.S. Walker Co., Inc.
ROCKDALE ST. • WORCESTER 6, MASS.
Original Designers and Builders of Magnetic Chucks

Walker CERAMAX chuck holds eight pieces for gang milling

A Walker Ceramax Chuck holds steel pieces during shaping operation



cool work instantly ...by evaporation

As you know, seeing what you're doing is half the battle, knowing what you're doing is the other half . . . and it will probably lead to Spraymist mist coolant systems by Bijur. With Spraymist on your machines an atomized coolant-air mixture instantly cools the work by evaporation . . . on contact. This keeps the work, the machine and the operator clean and dry – and insures complete, *full-time* visibility. The coolant starts from the pressurized reservoir and ends in a precisely regulated mist at the jet tip—not the tube—eliminating flooding, sputtering and condensate drip.

One economical Spraymist unit can supply 10 or more jets—each individually controlled by its own needle valve—insuring perfect cooling, at *all* operating speeds . . . on *any* machine. Why not yours? Write for details today and discover how inexpensive it is to add Spraymist to your production machines. 4141

BIJUR

LUBRICATING CORPORATION
153 West Passaic St. • Rochelle Park, N. J.
Pioneers in Automatic Lubrication

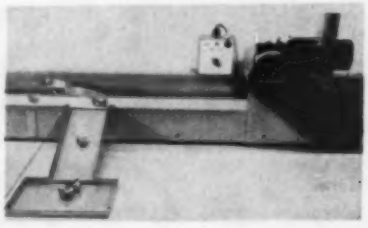
Turntable Speeds Cutoff Of Large Steel Castings

Variable-speed turntable is shown in use in cutting-off operation in the processing of large steel castings. Formerly the risers on these castings were removed manually. With the new system, the gas cutting torch is clamped in a stationary position and the casting revolves past it.

Operator mounts the casting on the 4-ft turntable which has a capacity of 5 tons. The casting revolves past the lighted torch at the necessary cutting speed. Table has a variable peripheral speed of from 2 to 20 ipm. Upon completion of the cutting process, the operator can revolve the table manually to any other position for cutting off another riser.

Matcon Machinery Co, Stamford, Conn

MORE DATA? Circle 117, inside back cover



Modular Small Parts Conveyor Adapts to Any Bench Layout

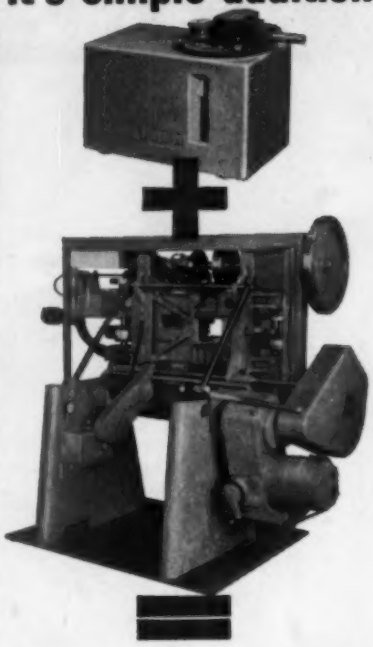
This 4-in.-wide unit (reported to be about half the cost of bulkier, cut-down models) has variable or fixed speed drive and rubber feet to absorb vibration. It incorporates a spring-loaded automatic tension device, and tracking can be done from both ends.

Mounting can be at front, top, or under bench. Speeds range from ½ to 30 fpm. Widths are from 2 to 6 in.; 4 in. is standard. Accessories include loading and unloading chute, sweep finger, collection tray, and side extensions.

Products For Industry Inc, 1704 Summer St, Stamford, Conn

MORE DATA? Circle 118, inside back cover

it's simple addition



lower maintenance costs longer machine life and higher production

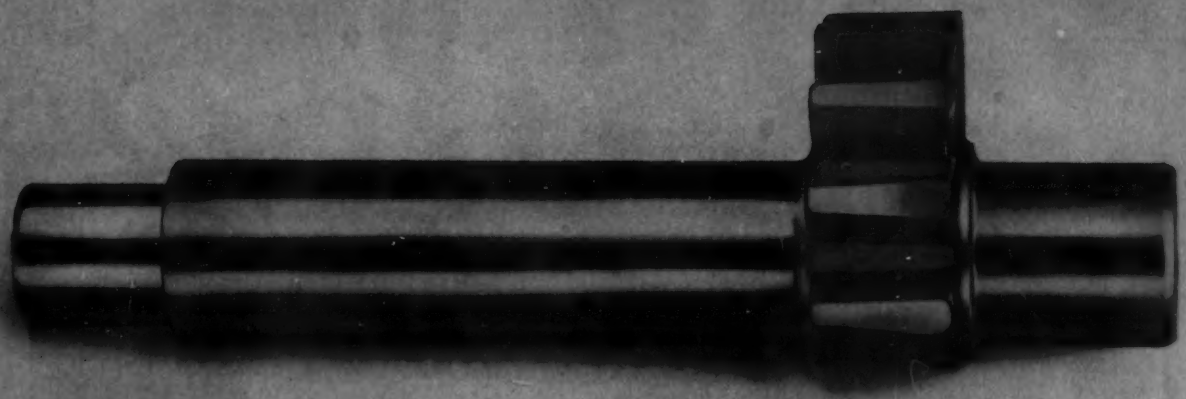
For years, machinery builders have been calling on Bijur to design the right automatic lubrication system for their machines. These manufacturers have learned that Bijur systems mean lower maintenance costs, longer machine life and higher production—advantages that add up to solid customer satisfaction.

No doubt *you* are now enjoying the advantages of Bijur systems on many of *your* machines. And, like most, you've probably noticed that these machines are outproducing others doing the same job. But did you know how simple and inexpensive it is—in both money and time—to convert these other machines to Bijur Automatic Lubrication? And the cost of Bijur systems is very quickly amortized. First-cost economy, higher production, plus *real* savings in maintenance costs and reduced downtime are the reasons for this rapid amortization.

When buying new machines, specify Bijur as original equipment. For now, write for complete details on the simple addition of Bijur Automatic Lubrication Systems. 4141

BIJUR

LUBRICATING CORPORATION
153 West Passaic St. • Rochelle Park, N. J.
Pioneers in Automatic Lubrication



THE Gleason Revacycle® method and its machine present the fastest way known for cutting precise straight bevel gears.

The Revacycle cutter holds roughing, semifinishing, and finishing blades. One revolution of the cutter completes a tooth space in 2.5 seconds. In fact, on smaller pieces, you can complete as many as four tooth spaces with a single cycle . . . that's less than ½ second per tooth!

This completely automatic Gleason machine can frequently replace a tandem of roughing and finishing machines . . . thereby saving considerably on capital investment.

Best of all, to get this speed and economy you need sacrifice nothing in accuracy. The Revacycle method produces localized tooth bearing which permits any practical assembly tolerances while avoiding load concentration at the ends of the teeth. And, you get exact reproduction piece after piece, day after day.

The machine accepts a wide range of work: diameters up to 10″ at a 5 to 1 ratio and face widths up to 1.25″.

For complete background and data, write for a bulletin. Gleason engineers will help you with details on any specific applications.

How to cut a bevel gear tooth in 2.5 seconds

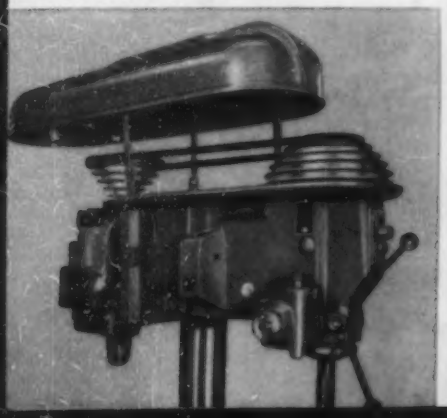
1.2 SECONDS is all it takes to dechuck a finished piece and chuck in a new blank with the automatic loading attachment on the 109 Revacycle Machine.

GLEASON WORKS

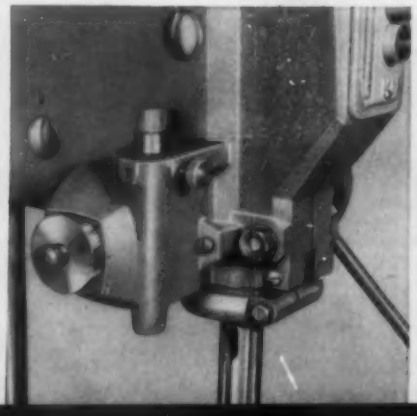
1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

ALL NEW Capacity—Equipped with exclusive Rockwell Power Feed (tested through 750,000 drilling cycles) the all new 17" drill presses handle many production jobs ordinarily done by costly, fixed equipment. In addition, they offer portability that can be utilized to perform extra drilling operations on limited runs or to relieve production line bottlenecks.

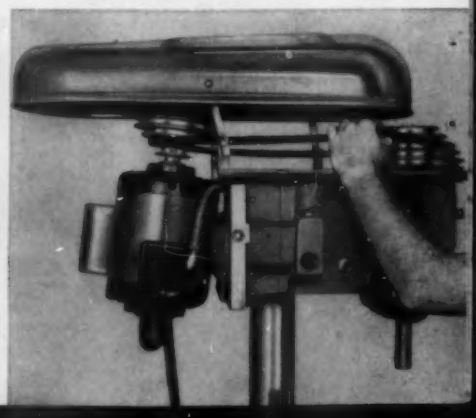
ALL NEW Interference-free Guard
—Tilts up and back out of the way giving operator plenty of room to make belt and speed changes quickly, easily. Three specially designed supports and a stop hold steel guard in "up" position, built-in clips automatically lock guard in operating position when closed.



ALL NEW Internal Depth Stop Mechanism—A new concept in depth stops that eliminates bottom-of-stroke quill deflection which causes excessive drill breakage and downtime. Convenient adjustment knob permits fast, one hand operation, locks in position to stop pinion shaft at same depth through repeated cycles.



ALL NEW Pivot-type Motor Mount
—Assures full release of belt tension before changing from one pulley speed to another, delivers longer belt life and eliminates possibility of damage to the belt. Maintenance of proper running tension on belt at all times prevents undue wear on bearings.



You can do more with these

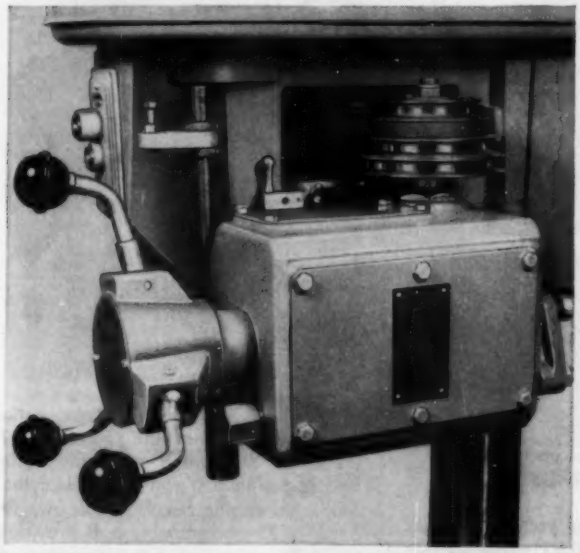
ALL NEW DELTA 17" DRILL PRESSES

Here is a major engineering advance from Delta to give you increased drilling accuracy, more job flexibility and greater operating economy. You can choose the machine best suited to your needs from 76 models in a complete line of 17" drill presses that incorporate the most up-to-date performance features available.

These drill presses are completely new—not merely improved or re-styled—but actually re-designed to deliver consistent precision operation under the most rugged work loads with little or no maintenance.

With the introduction of this all new 17" drill press line, Delta continues to provide the high quality of product that has made it the leading name in drill presses for over 31 years. Your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages) will gladly demonstrate how these 17's can save you dollars, hours and material. Why not call or see him soon!

FREE BROCHURE—Complete specifications and details on the full line of all new 17" drill presses and accessories. Simply write: Rockwell Manufacturing Company, Delta Power Tool Division, 618C N. Lexington Ave., Pittsburgh 8, Pennsylvania.



ALL NEW Rockwell Power Feed—Available as original equipment or as an accessory on every model, this advanced development in mechanical power feeds gives you: a front mounted pilot wheel for one hand operation and "flick of the wrist" control of feeding; infinitely adjustable drill point pressure and a built-in feature that permits remote control. For semi or fully automated operations, power feed can be electrically, hydraulically, pneumatically or mechanically interlocked with other machines.

CHOOSE FROM 76 MODELS

Selection includes: floor, bench or multiple spindle machines equipped with standard or production table, standard or Rockwell Power Feed, key chuck or tapered spindle, high or slow speed.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

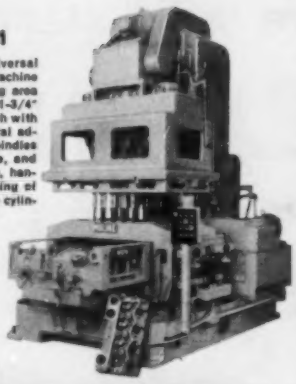
CIRCLE 292 READER SERVICE CARD

HD13

straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.

MODEL HU111

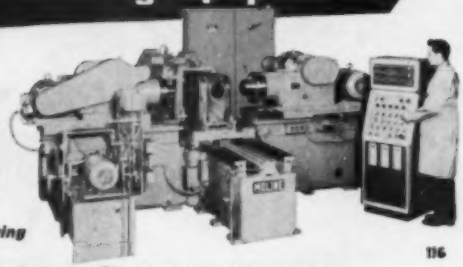
Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 30" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.



MOLINE Cost Reducing Equipment

MODEL MR148

Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.



68 years of Machine Tool Engineering Experience is at your service for 116

- Multi-Spindle Boring • Single and Multi-Spindle Honing
- Straight Line Multi-Drilling • Adjustable Spindle Drilling
- Special Multiple Operation Machine Tools *Write for Details*

MOLINE TOOL CO.

MOLINE TOOL COMPANY
100 20TH STREET • MOLINE, ILLINOIS
REPRESENTATIVES IN PRINCIPAL CITIES
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THESE BENEFITS ARE YOURS

when your drills are sharpened on

the Model 100-A

WINSLO-MATIC DRILL POINTER

20" diameter grinding wheel

- ... extremely true, close-tolerance holes within .001 of drill size (even in the new super-metals) since drill points are concentric within .0002.
- ... precision conventional chisel type drill points as well as **helical** (self centering) drill points essential to optimum performance on **tape controlled** drilling machines.
- ... increased production from every drill because drills last up to twice as long.
- ... elimination of most reaming requirements.
- ... faster, more precision drilling with fewer rejects.

Get these benefits... and many more with the completely automatic WINSLO-MATIC DRILL POINTER. Handles drills from 1/32" to 1½" diameters.

Write for descriptive literature and check for yourself the many exclusive advantages of the versatile WINSLO-MATIC Drill Pointer.

Winslow PRODUCT ENGINEERING CORPORATION
47 ST. JOSEPH STREET • ARCADIA, CALIFORNIA
CIRCLE 294 READER SERVICE CARD

Automotive Test Equipment Hikes Automotive Parts Inspection

Automated test stand for production testing of the reaction time in automotive power steering valves and subassemblies will automatically run nine separate performance tests in a 15-sec time cycle. Fifteen minutes is required to perform the same test manually.

The test equipment is available in three ranges of complexity and cost: simplified, lowcost units for field use; precision manual units for use in research and development or in the receiving inspection departments of automotive manufacturers; and fully automatic equipment for production inspection.

Bendix Corp, Bendix Products Div, 401 N Bendix Drive, South Bend 20, Ind

MORE DATA? Circle 119, inside back cover

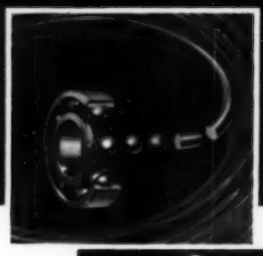
FOUR-STATION, shuttle type, slip spindle drilling machine is one of 12 that form segmented production line for processing cast iron V-8 or six cylinder truck engine heads. Basic design handles 25 parts an hr, and provides for quick retooling for planned and eventual product design changes—*F Jos Lamb Co, 5663 E Nine Mile Rd, Detroit 34, Mich*

MORE DATA? Circle 120, inside back cover

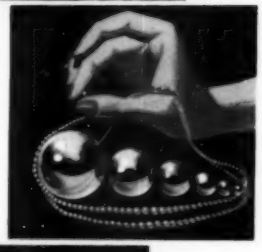
CIRCLE 295 READER SERVICE CARD ►

hoover quality

. . . CONTROLLED FROM START TO FINISH

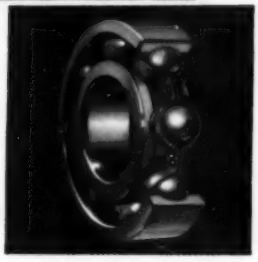


High quality chrome alloy steel wire is produced by the Cuyahoga Steel and Wire Division of Hoover Ball and Bearing Company.



Micro-Velvet balls are produced in the Hoover Ball Division plants in Middletown, Ohio, and Erwin, Tennessee.

Hoover is actively engaged in the development of an expanded line of non-destructive electronic inspection equipment.



Hoover Quality bearings are the final result of the combined know-how of highly specialized, yet integrated Hoover divisions.

Hoover Quality, widely recognized by bearing users, is the result of complete control of every step in the manufacture of bearings.

Specialized knowledge gained through the operation of its own wire drawing mill aids Hoover in setting and controlling the quality standards of wire from which balls are made.

As America's leading producer of balls, Hoover has the experience and equipment it takes to make balls of exceptional quality. *Micro-Velvet* balls used in Hoover bearings are accurate within millionths of an inch!

And Hoover utilizes exclusive processes that assure product superiority. *Hoover Honed* raceways are super smooth, superbly finished. Testing and inspection at various stages of manufacturing are accomplished with specially designed equipment. Even non-destructive electronic inspection is employed.

Hoover Quality is the result of complete control . . . from start to finish.

hoover

BALL AND BEARING COMPANY

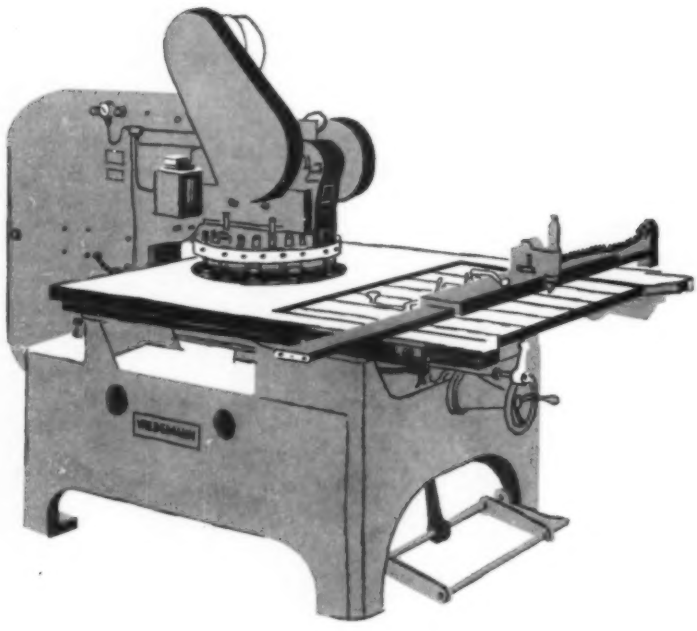
5400 South State Road, Ann Arbor, Michigan

Zone Sales Offices and Warehouses

8581 South Chicago Ave., Chicago 17, Illinois
290 Lodi Street, Hackensack, New Jersey
2020 South Figueroa, Los Angeles 7, California

Micro-Velvet and *Hoover Honed* are Hoover Trademarks.

REMEMBER?



The blacksmith is one of the oldest metal fabricators. He served a long apprenticeship to learn how to accurately produce metal parts of almost any shape manually, employing little or no power equipment. Remember?

Metal fabricators frequently think along these lines and depend on skill and dexterity to produce accurate parts.

The "Wiedemann Method" employs mechanical work positioning equipment so simply that inexperienced men may become skilled operators in a very short period of time, often in a few days. Efficient, self trained Wiedemann operators and turret punch presses have replaced this slow costly hand work of metal fabricators.

Let Wiedemann Machine Company solve your hole positioning and punching problems. Learn how, merely by installing the "Wiedemann Method" you can realize 60% to 90% savings in your piercing operation. Drop us a line.

From the versatile 150 ton R-15 down to the hand operated R-2, there's a Wiedemann for your short run piercing requirements.

WIEDEMANN

WIEDEMANN MACHINE COMPANY

Dept. AM3 Gulph Road • King of Prussia, Pa.

Now you can get any soluble coolant you need . . . from one source . . . Sunoco

Sun is literally a supermarket for soluble oils—all the way from a low-cost emulsifying oil to a chemical coolant. Each one can solve a different production problem. For example:

For versatility at moderate cost, use regular S.E.C.O. (Sunoco Emulsifying Cutting Oil).

For heavy-duty work, use S.E.C.O. HD.

For high detergency, machine or grind with S.E.C.O. 271.

For high-power wetting and lubricity, use Sun's new chemical coolant, Sunicool.

You can profit by checking into the benefits of Sun Soluble Cutting Oils. They've led the field for years . . . they're backed by Sun Oil . . . they're good. And so are Sun's many straight and compounded oils. Ask your Sun man for all the details, or write to SUN OIL COMPANY, Dept. AM-3, Philadelphia 3, Pa. In Canada: Sun Oil Company Limited, Toronto and Montreal.

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

BUY FROM STOCK AND SAVE

WILLIAMS
DROP-FORGED
HANDLES

Why use "specials" when Stock Handles from your Williams Industrial Distributor can do the same job and save you money? Eleven Crank Handles from 1¾" to 10" (C. hub to C. handle). Eight Balance Handles from 1¼" to 3⅞" (C. hub to C. handle). Nine Ball Pattern Machine Handles from 2" to 6⅛" long. Four Cone Pattern Machine Handles from 3½" to 6". Crank and balance handles heat-treated.

4 STYLES, 62 STOCK ITEMS
HANDLE MOST REQUIREMENTS

J. H. WILLIAMS & CO.
DIVISION OF UNITED-GREENFIELD CORPORATION
408 VULCAN ST., BUFFALO 7, N.Y.

WILLIAMS

CIRCLE 298 READER SERVICE CARD

EXTRA TOUGH TO RESIST CONSTANT SHOCK

WILLIAMS
POWER DRIVE
SOCKETS

Your Williams Distributor is ready for action with Williams Power Drive Sockets. Made of extra tough alloy steel. Specially heat-treated to withstand constant impacting and power nut running. Available in 7 drive sizes: ¼", ⅜", ½", ⅝", ¾", 1" and 1½". Hex, double hex and square openings from 5/16" to 3½". Standard and bolt clearance lengths, magnetic styles, plus adapters, extensions and shanks offer complete range of service.

430 SOCKET ITEMS, 7 DRIVE SIZES
FOR ALL TYPES OF POWER WRENCHES

J. H. WILLIAMS & CO.
DIVISION OF UNITED-GREENFIELD CORPORATION
408 VULCAN ST., BUFFALO 7, N.Y.

WILLIAMS

CIRCLE 300 READER SERVICE CARD

FAST SET-UP • ACCURATE PERFORMANCE

WILLIAMS
DROP-FORGED
TOOL HOLDERS

Standardize on Williams Tool Holders . . . available in a complete range of sizes and patterns for turning, boring, threading, knurling, planing, cutting-off and side work. Correctly designed for fast, easy set-up and rigid, chatter-proof cutting. Drop-forged from tough quality steel . . . heat-treated for added strength . . . machined to close tolerances. Your Williams Distributor can also supply a full line of high speed cobalt and carbide cutters.

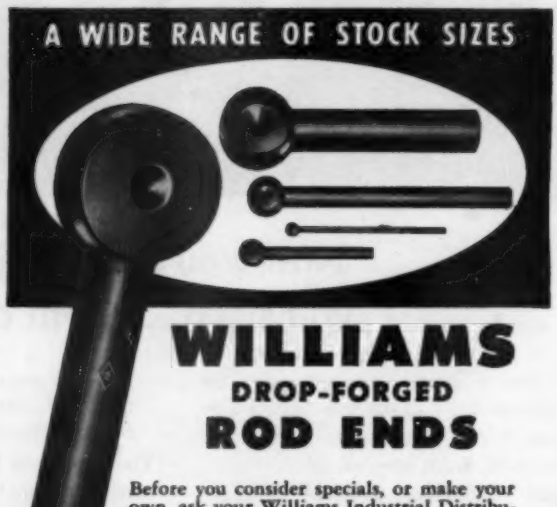
FOR ALL REGULAR LATHE AND PLANER OPERATIONS

J. H. WILLIAMS & CO.
DIVISION OF UNITED-GREENFIELD CORPORATION
408 VULCAN ST., BUFFALO 7, N.Y.

WILLIAMS

CIRCLE 299 READER SERVICE CARD

A WIDE RANGE OF STOCK SIZES



WILLIAMS
DROP-FORGED
ROD ENDS

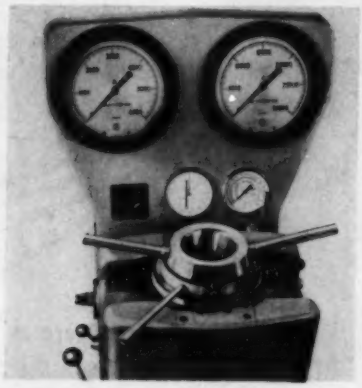
Before you consider specials, or make your own, ask your Williams Industrial Distributor to show you the broad line of Williams Rod Ends. They are drop-forged from mild steel which welds easily. Many sizes are centered for fast drilling. Shank diameters from 3/16" to 1¼"... lengths from 1¾" to 24". Head diameters from ⅜" to 2 5/16"... thicknesses from ¼" to 1½".

SAVE WITH STOCK ROD ENDS
36 SIZES TO CHOOSE FROM

J. H. WILLIAMS & CO.
DIVISION OF UNITED-GREENFIELD CORPORATION
408 VULCAN ST., BUFFALO 7, N.Y.

WILLIAMS

CIRCLE 301 READER SERVICE CARD



Tinius Olsen Sheet Metal Tester Cuts Costs, Prolongs Die Life

The Ductomatic sheet metal tester simulates actual deep drawing press operations. The machine is said to predict the ductility or forming quality of sheet metal with an exceptionally high degree of accuracy.

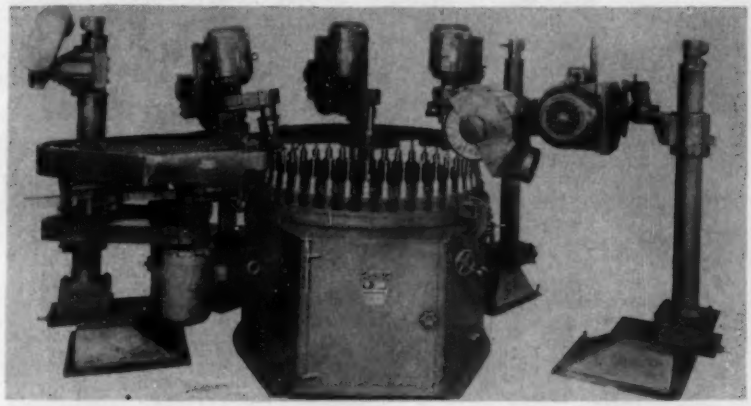
By substituting the interchangeable plunger and dies, the Ductomatic can also be used for deep draw cupping tests, hole expansion tests, optimum clamping pressure determinations, and electrical lacquer tests for studying the adhesion and flexibility of paint finishes. An optional electronic shut-off automatically stops the test when the first sign of a crack appears.

The company claims use of its new machine cuts scrap losses and rework costs to a minimum, and prolongs the life of costly dies.

The testers are available in capacities from 12,000 to 70,000 lbs.

Tinius Olsen Testing Machine Co, Easton Rd, Willow Grove, Pa

MORE DATA? Circle 121, inside back cover



AUTOMATIC ROTARY POLISHING AND BUFFING MACHINE converts—in less than one minute—from rotary indexing to continuous rotary motion to permit finishing operations on a variety of parts. Index and continuous drives are combined, and continuous table drive and spindle drive are both equipped with 3 to 1 ratio adjustable speed unit—*Acme Mfg Co, 1400 E Nine Mile Rd, Detroit 20, Mich*

MORE DATA? Circle 122, inside back cover

DEPENDABLE FOR EVERYDAY USE
WILLIAMS
MISCELLANEOUS
HAND TOOLS
Over 550 Williams Hand Tools are available . . . Screwdrivers, Pliers, Hammers, Punches, Chisels, Pullers, Chain Wrenches, Tube Cutters, Flaring Tools . . . to mention only a few. All are made for heavy-duty, long-lasting performance. Whatever the job at hand, you can do it quickly, easily and safely with Williams Hand Tools.
CALL YOUR WILLIAMS DISTRIBUTOR
HE CAN GIVE IMMEDIATE SERVICE
J. H. WILLIAMS & CO.
DIVISION OF UNITED-GREENFIELD CORPORATION
408 VULCAN ST., BUFFALO 7, N.Y.
WILLIAMS

CIRCLE 302 READER SERVICE CARD

DEPENDABLE ALLOY & CARBON STEEL
WILLIAMS
DROP-FORGED
HOIST HOOKS
Recent improvements in design and material make Williams Alloy and Carbon Steel Hooks the strongest, safest to specify. Each is heat-treated for maximum toughness and high impact resistance. All are proof-tested to military standards to 50% beyond safe working loads. Available in eye and shank styles in regular and safety patterns. Safety latches feature non-corrosive snap springs with positive, safety action. Alloy steel capacities up to 70 tons . . . carbon steel capacities up to 60 tons. Order from your Williams Distributor.
SIXTEEN STOCK SIZES
CAPACITIES UP TO 70 TONS
J. H. WILLIAMS & CO.
DIVISION OF UNITED-GREENFIELD CORPORATION
408 VULCAN ST., BUFFALO 7, N.Y.
WILLIAMS

CIRCLE 303 READER SERVICE CARD

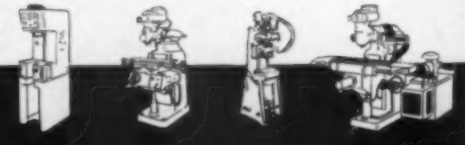
Famco Squaring Shears
cut *Everything*

Including your shearing costs

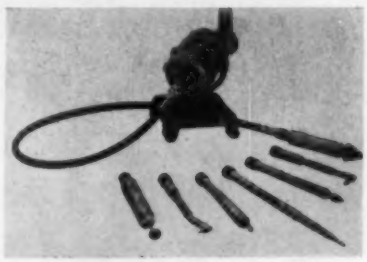
Today in practically all types of industry Famco power shears are at work. These all steel giants assure their owners greater accuracy, maintenance-free performance and longer shear life. Shear economy, too.

Perhaps you have a ticklish cutting problem. Chances are we can solve it. Our years of experience in shear design and construction are yours for the asking. Send for our standard and special line shear brochure.

Products of Famco
Air, Manual, Power and Hydraulic Presses, Milling Machines, Tracer Mills, Band Saws



FAMCO MACHINE COMPANY
KENOSHA, WISCONSIN



Miniature Power Tool Operates At Speeds to 12,000 rpm

Series GG is a bench-type flexible shaft machine that incorporates a carbon-pile, continuously variable foot rheostat. It is equipped with a 1/10-hp universal motor with two separate speed ranges. Gearbox gives high torque at low speeds; high speeds up to 12,000 rpm can be obtained on direct drive. The 9-lb unit plugs into any 110-v ac or dc outlet.

Wide selection of company's handpieces are interchangeable. They accept rotary tools of all kinds with shanks from, 1/32 to 1/4 in., depending upon model. Cost of the complete unit ranges from $74 to $87, according to handpiece selected.

Foredom Electric Co, Bethel, Conn

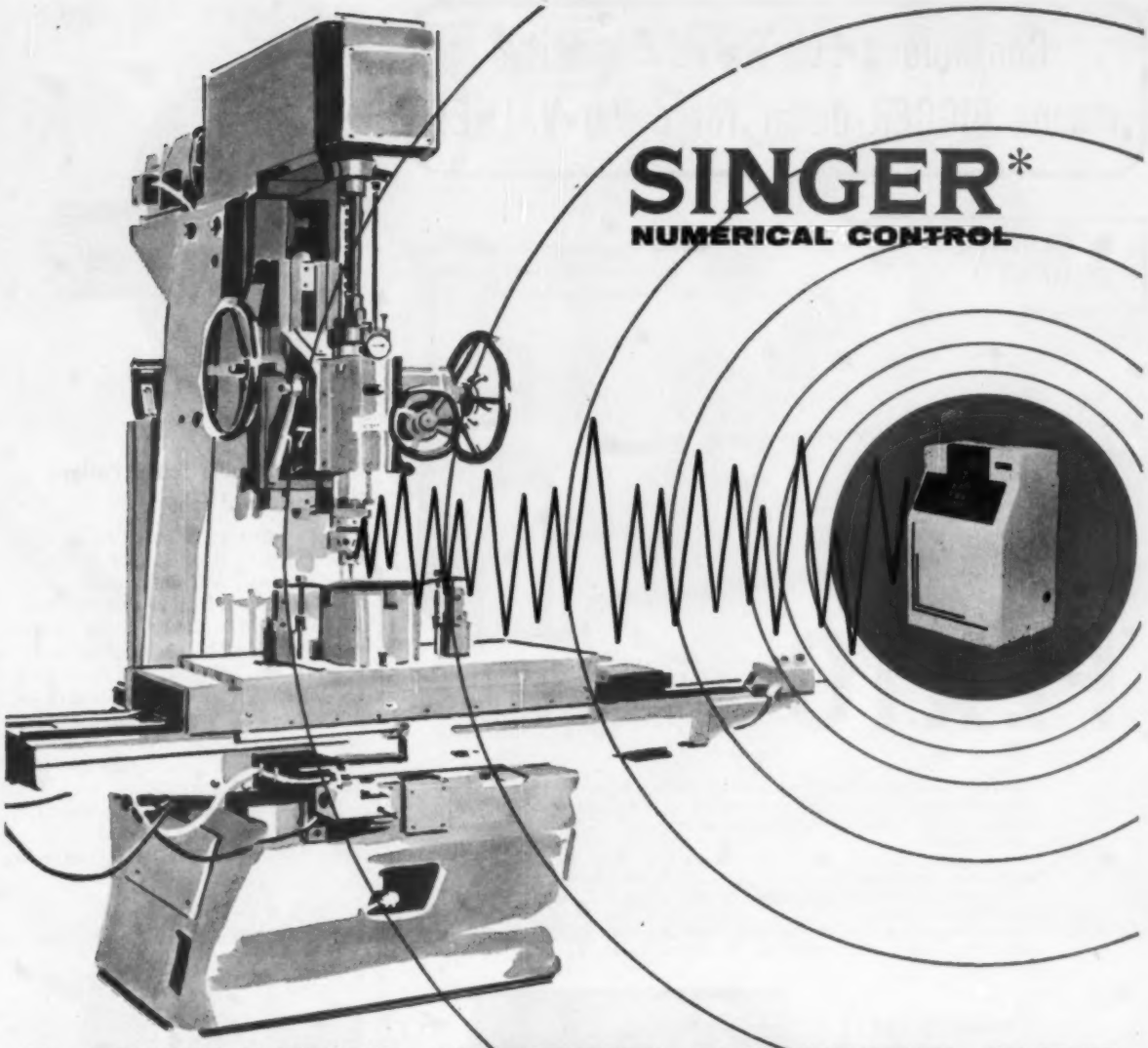
MORE DATA? Circle 124, inside back cover

High-Speed Portable Cutter Develops 5 tons of Thurst

Model MC-205-K cuts through a 7/16-in. mild steel rod in 3 sec. Cast aluminum cutting head weighs 6½ lb and blades can be easily replaced. Model is powered by a 110-v ¾-hp motor; hydraulic valve control utilizes new S-4 solenoid valve. Weight of the entire mobile power unit is 65 lb.

Manco Mfg Co, Bradley, Ill

MORE DATA? Circle 125, inside back cover



A DYNAMIC NERVE CENTER FOR THE MACHINE TOOL INDUSTRY

A SINGER Achievement . . . the most direct approach to point-to-point positioning yet conceived. The SINGER Numerical Control System offers simplicity, reliability and economy, reducing costs of maintenance, labor and down-time.

DISCRETE POSITIONING: UP TO 40" OF TRAVEL, ACCURACY OF .001

SINGER Numerical Control makes possible a high degree of accuracy by a division of the measuring section and the motor drive within the system.

The SINGER System also features *modular design*, making it possible to assemble basic units in a variety of control systems.

And, of prime importance, all modules and motors are designed, serviced and built by Diehl Manufacturing Company, a SINGER subsidiary.

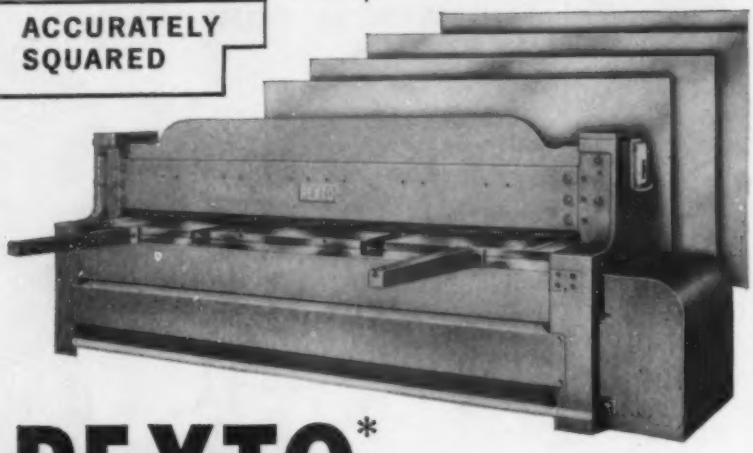
To see SINGER Numerical Control in action, visit the unique demonstration room at the Diehl Plant near Somerville, New Jersey. Here you can examine actual production records as evidence of the economy, reliability and accuracy of this advanced point-to-point positioning system. Call or write for an appointment at the address below.

DIEHL MANUFACTURING COMPANY
SUBSIDIARY OF THE SINGER MANUFACTURING COMPANY
Finderne Plant, Somerville, New Jersey
Telephone: Randolph 5-2200

*A Trademark of THE SINGER MANUFACTURING COMPANY
†A Trademark of THE DIEHL MANUFACTURING COMPANY

Continuous Full Rated Capacity means BIGGER dollar for dollar VALUE!

ACCURATELY SQUARED



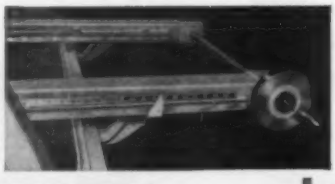
PEXTO*

*Registered Trademark

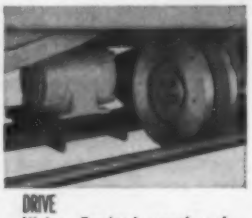
10-U-10
A complete line

PEXTO Power Squaring Shears have design features that provide unparalleled full capacity shearing with squaring accuracy, delivering top production all day, every day . . . even at full-rated capacity.
These world famous Squaring Shears are built from heavy, high-grade machine tool castings, and have self-compensating holddowns, precision gauging with maximum cutting-life from four edged blades.
These are but a few of the important features PEXTO Power Squaring Shears offer. Write for the latest literature.

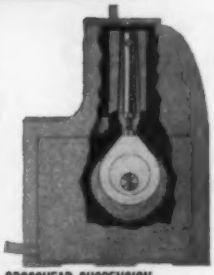
STANDARD BACK GAUGE
NEW improved design. PEXTO has added a new measure of precision, with fast, self-reading dial setting. Gauge can be locked in any position. Graduated in 128ths of an inch.



GEAR TRAIN
Double reduction gearing through modern 20° pressure angle steel pinions and cast gears provides smooth power transmission.



DRIVE
Higher flywheel speed and Timken bearings add accuracy and smoothness. Motor base can be adjusted in seconds.



CROSSHEAD SUSPENSION
A unique method of mounting means efficient use of power and effective reduction of side-thrust and wear.

Pexto Squaring Shears are sold through Dealers and Distributors . . . Send for Bulletins 57 and 60.

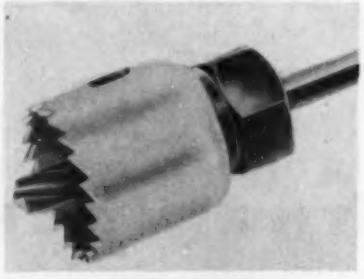
THE PECK, STOW & WILCOX CO. Southington, Conn., U.S.A.
A complete line of machines and tools for Sheet Metal Fabrication . . . Since 1785

Line of Variable Speed Pulleys Fits Variety of Jobs

Pulleys rated at 20 to 25 hp at 1750 rpm and 10 to 15 hp at 1150 rpm provide instantly variable ratios up to 3:1. Designated Nos. 20 and 325, they use a No. 27 (2¾-in.) top width variable speed belt. Standard bores are 1¼, 1⅜, 1⅝, and 1⅞ in. with a 3¾-in. bore length. Motor travel for full range is 6¾ in. Maximum pitch diameter is 13.1 in. and minimum is 4.35 in. Overall dimensions are 14¼ in. long by 13⅜ in. OD.

Lovejoy Flexible Coupling Co, 4966 W Lake St, Chicago, Ill

MORE DATA? Circle 126, inside back cover



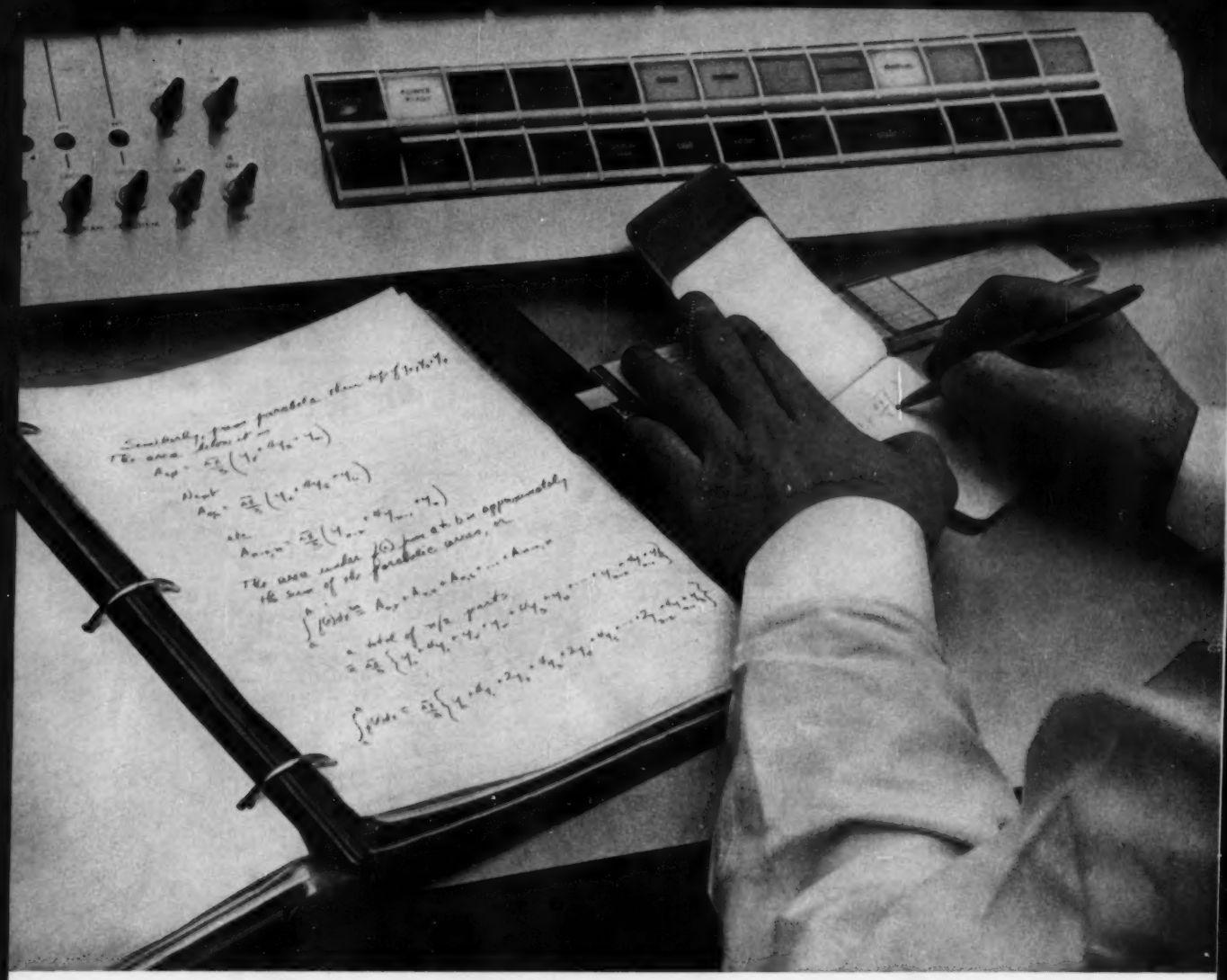
New Sizes of Hole Saws Added to Clemson Line

Star Speedi-cut hole saws in sizes from ⅝ through 2½ in. are adaptable to electric drills, lathes, and drill-presses, and will penetrate two or more layers of wood, metal, plastic, or composition board.

Cutting up to ⅞ in. deep, holes made with the ¼-in. drill can be extended to 1⅛ in.; with the ⅜-in. drill to 1½ in.; and with the ½-in. drill to 2½ in. The ⅝-in. saw in the new line features a built-in mandrel; other sizes are interchangeable with mandrels of various makes. All saws have knock-out holes.

Clemson Bros Inc, Middletown, NY

MORE DATA? Circle 127, inside back cover



Free engineers for creative assignments with the new low-cost IBM 1620

The IBM 1620 Data Processing System is a low-cost solution to the problem of freeing engineers for their most creative and profitable assignments. Here's why:

EASY TO USE—Just a two-day training class is all you need to put your 1620 into operation. This means no delays in learning to use the 1620 computer.

In addition, you get a wide range of free programming services including FORTRAN and GOTRAN. FORTRAN is the powerful scientific language that lets you solve problems without writing detailed computer instructions. GOTRAN is a simplified language (a sub-set of FORTRAN) that lets you enter simplified problem statements and data into the computer with the solution immediately available, in one simple operation.

FAST—The 1620 solves a set of ten simultaneous equations in only 20 seconds. It inverts a 10 x 10 matrix in just 42 seconds.

POWERFUL—The 1620 inverts a 40 x 40 matrix. With optional additional core storage the 1620 can handle matrix inversion problems of a much higher magnitude.

GET FULL DETAILS—The 1620 is the most outstanding engineering and scientific computer in its price range. A basic installation rents for just $1,600 a month.

To learn how the 1620 can free you for more creative engineering work, call your local IBM representative.

IBM's 1620 is a compact desk-size computer.

IBM®
DATA PROCESSING

CIRCLE 307 READER SERVICE CARD

FEDERAL
MIRACLE MOVEMENT
DIAL INDICATOR
FEDERAL
FEDERAL PRODUCTS CORPORATION
PROVIDENCE, R.I. U.S.A.
Model C5M
.0005"

FINALLY . . . A DIAL INDICATOR WHOSE MOVEMENT MECHANISM IS SO WEAR-RESISTANT . . . SO SHOCK-RESISTANT . . .

You Will Probably Never Have to Repair or Replace It!

We say "probably" because it's likely that some MIRACLE MOVEMENT Indicators will meet up with such out-and-out abuse that their operation may ultimately be impaired. But, given the same hard shop usage as any other Dial Indicator, a MIRACLE MOVEMENT Indicator will outlast it many times over.

The MIRACLE MOVEMENT Indicator is not only wear-safe . . . it's also shock-safe. Contrary to what you might expect, no supplemental, "extra-price" devices need be added to the movement to obtain this protection. The MIRACLE MOVEMENT *itself* is shock-safe. So you get this protection automatically. You do not have to specify it . . . you do not pay extra to get it. Every MIRACLE MOVEMENT Indicator has it.

Nor do you have to specify MIRACLE MOVEMENT in order to get the finest Indicator of them all. From now on, *all* Federal Dial Indicators, except Super-Sensitive and Special Movement Models, will have the MIRACLE MOVEMENT. So, to have all these important features . . . all you have to do is specify Federal.

And, as you might expect, your present Federal Dial Indicator can be converted easily because the MIRACLE MOVEMENT is also available separately as a replacement unit, either Full-Jeweled or Plain Bearing. It fits into a current Model Indicator case without any changes. **You owe it to better, longer lasting accuracy and to drastically reduced Indicator maintenance costs to standardize on Federal MIRACLE MOVEMENT Indicators.**

. . . certainly the finest of them all.

MIRACLE MOVEMENT

FEDERAL PRODUCTS CORPORATION

1123 EDDY STREET • PROVIDENCE 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

for recommendations in modern gages . . . Dial Indicating • Air • Electric or Electronic — For Inspecting, Measuring, Sorting, or Automation Gaging.

Speed your forming and fabricating

di-acro PRECISION METALWORKING EQUIPMENT

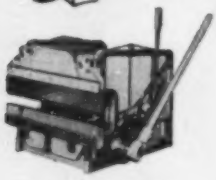
pronounced die-ack-ro

Find Us Fast In The Yellow Pages

QUICK FACTS FOLDER describes all Di-Acro machines and tells how they speed your metalworking. For your free copy consult the yellow pages under Machinery-Machine Tools for your distributor or write us.

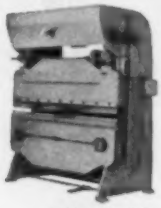
O'NEIL-IRWIN MFG. CO.
213 Eighth Avenue • Lake City, Minnesota

PRESS BRAKES



1 Hand Operated Model

3—12 Ton Models

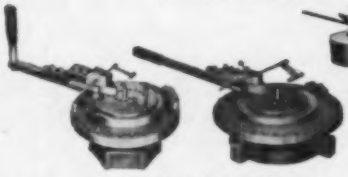


2—25 Ton Models

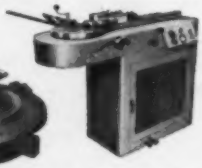
BRAKES

11 Hand Operated Models

BENDERS



5 Hand Operated Models



2 Power Models

SHEARS and NOTCHERS

1 Hand Operated Notcher

1 Power Notcher

5 Hand Operated Shears

4 Power Shears

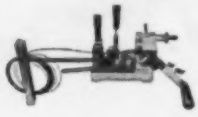
PUNCH PRESSES

2 Hand Operated Models

2 Power Models

1 Turret Model

SPRING WINDER



1 Hand Operated Model

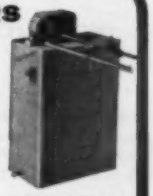
ROLLERS

8 Hand Operated Models

6 Power Models

ROD PARTERS

2 Hand Operated Models



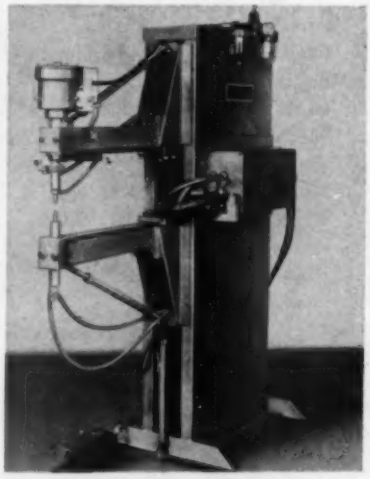
6 Power Models

Lowcost Ultrasonic Cleaner Has a 1¼-qt Capacity

The Maxson, priced at $97.50 features a built-in electronic circuit that transmits peak power directly from the transducer to the cleaning tank. Furnished with a stainless steel cover, the unit is designed to clean a high volume of large pieces faster. It is ready for plug-in operation in a space measuring 8 x 6 in.; power output is 45 w; power consumed is 140 w; operating frequency is 70-80 kc.

L & R Mfg Co, 577 Elm St, Kearny, NJ

MORE DATA? Circle 128, inside back cover



Spot Welder Handles Work From 22-gage to 1/8-in. Thick

First in a new line of economy welding equipment, unit operates on regular 80-psi line pressure, develops a clamping force of 1950 lb, and has complete lubricator, strainer, and pressure regulator system. Control is by standard foot switch. Air valve is integrally mounted with the 5-in. double-acting cylinder. Versatility of

use is achieved by the interchangeability of the compact, outboard mounted, standard package-type, stacked-core transformers available in a range from 20 to 75 kva. Spot welding of aluminum is possible by using a high voltage transformer.

Sealed tubular construction of the upper arm provides a close-coupled surge tank enabling unusually fast recovery of the air cylinder for consistent, rapid stroke action. Throat depth is adjustable from 12 to 36 in. Throat height is variable from 12 to 18 in.

Viking Products Co, Subs of Progressive Welder & Machine Co, 915 Oakland Ave, Pontiac, Mich

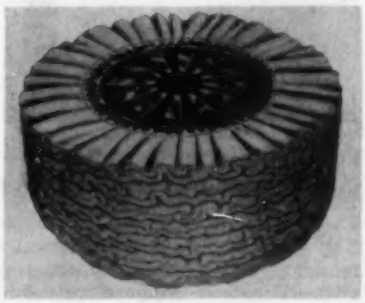
MORE DATA? Circle 129, inside back cover

Standard Line of Dovetail Blanks Expanded to 40 Items

Complete range of size in dovetail tools is available, in addition to a choice of either soft blanks or hardened and ground blanks, as well as a selection of M-2 HSS or T-5 HHS. Blanks can also be supplied in T-15 Vasco Supreme HSS as semi-standard if required.

Somma Tool Co, 109 Scott Rd, Waterbury, Conn

MORE DATA? Circle 130, inside back cover



CLOTH BIAS BUFFS used in high-speed lathe or similar operations are now being offered with Yellow Flameproof Treatment that imparts positive protection to all buffs so treated; they cannot ignite even when directly exposed to fire—*American Buff Co, 2414 La Salle St, Chicago 16, Ill*

MORE DATA? Circle 131, inside back cover

To get the most out of barrel finishing

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS

Barrel finishing cuts unit-cost of deburring from 15¢ to 1¢! How much could it save you?

In one midwest plant, total cost of deburring 20,000 complex aircraft parts by barrel method came to less than $200. This compares with a former cost of $3,000 by hand methods.

This startling reduction in cost is the result of handling hundreds of pieces at a time, instead of grinding each one separately . . . and the result, too, of using the right compound to help the media and barrel do their work.

It's in selecting and supplying the right compound that Oakite helps you get the most out of barrel finishing. Oakite compounds include alkaline and acidic types . . . for steel, brass, zinc die castings, aluminum or alloy parts.

Ask your local Oakite man about barrel finishing, or write for free booklet on barrel finishing to Oakite Products, Inc., 28A Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & DeLeeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.

Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.

Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Air-Loc Machinery Mounts Dampen Vibration as Much as 85%

The Jacmount consists of a cast steel baseplate, bonded to a heavy pad of Air-Loc, and a leveling screw assembly. Baseplate and a pad are only 1 in. high, assuring maximum rigidity and ease of installation. It can be used to install most types of machine tools but is not recommended for shapers, heavy-duty punchpresses, and similar machines.

Jacmounts are also available without the leveling screw assembly so that they may be installed under machines already having a jackscrew.

Clark, Cutler, McDermott Co, Franklin, Mass

MORE DATA? Circle 132, inside back cover

Radiation Thermometer Operates Remotely Between 210 and 3300 F

The Thermodot Model TD-6 radiation thermometer automatically measures and controls temperatures without contact. Designed for use in assembly line production, industrial testing, quality and process control, and automation systems, it is said to operate simply, rapidly, remotely and unattended.

The instrument measures temperatures from 210 F to 3300 F, and is compensated for ambient temperatures from 50 to 120 F (1-75 F with optional water cooling). Response

time is three-tenths of a second with the control panel having pushbutton temperature calibration. Price: less than $800.

Radiation Electronics Co, Div of Comptometer Corp, 5600 Jarvis Ave, Chicago 48, Ill

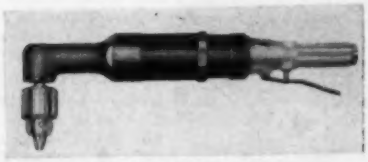
MORE DATA? Circle 133, inside back cover

Guide Line Light Furnished In New, Small Model

Model Q-5 casts clear, sharp shadow lines for cutting, marking, or assembly operations in small areas or low-ceilinged plants. Half the size of the Q-15 model, it utilizes a special new 500-w lamp less than ⅜ in. in diameter which will burn approximately 2000 hr without forming carbon deposits. The unit will project any desired number of parallel straight lines in a pattern 8 to 16 in. wide and 4 to 8 ft long.

Carter Products Co, Helmer Bldg, Grand Rapids 2, Mich

MORE DATA? Circle 134, inside back cover



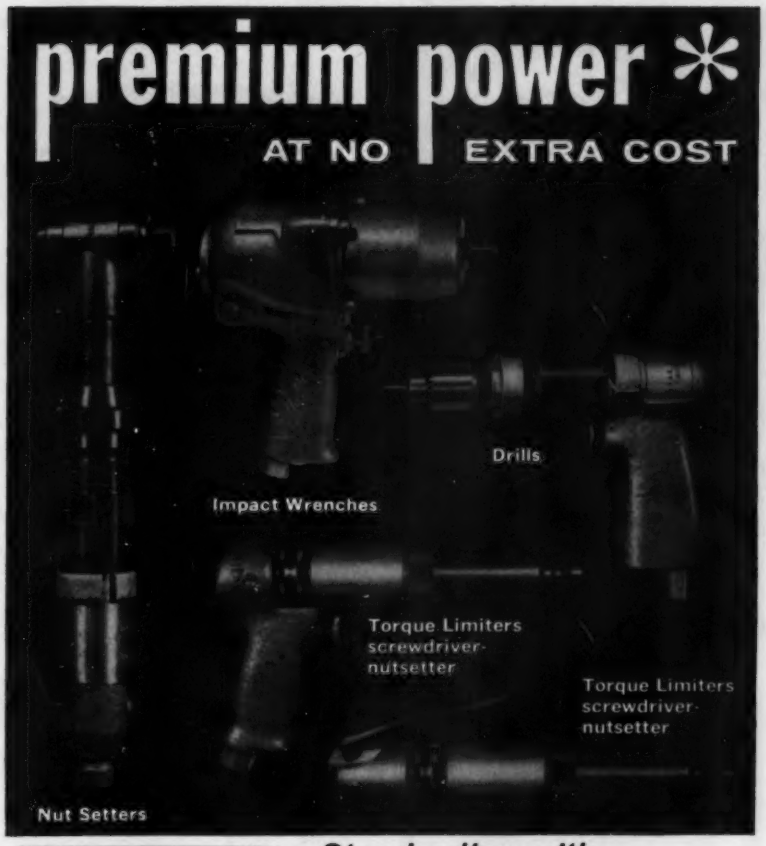
Air-Powered Right Angle Drill Has Drill Capacity of ½-in. dia

The 61A Series is available in speeds of 1000, 700, and 500 rpm, and with either a safety lever or thumb flip throttle. It has a maximum capacity of ½-in. dia drill in its six models. Overall length ranges from 16 to 17⅞ in., weights from 8¼ to 9 lb, and the angle head measures 2 in. high by 1¾ in. dia; all dimensions listed are exclusive of chuck.

Tool can be converted to a stall torque nutrunner of 9/16-in. capacity by replacing the threaded chuck spindle with a ½-in. square drive spindle.

Buckeye Tools Corp, 5003 Springboro Pike, Dayton 1, Ohio

MORE DATA? Circle 135, inside back cover



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Master Power Corporation, Dept. G-031, Solon, Ohio

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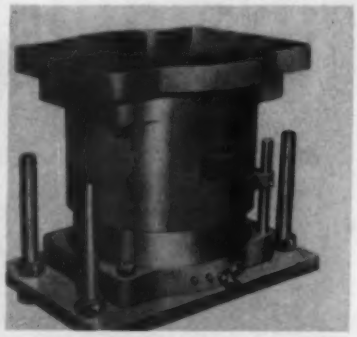
Torrington, Connecticut

CIRCLE 314 READER SERVICE CARD

NEW SHOP EQUIPMENT



New Power Press Die Cushion Ends Need For Press Bed Pit

This all-steel, telescoping, full universal pneumatic die cushion is said to give complete overall ring holding pressure on practically any power press without the requirements of a press bed pit. New minimum overall height can be provided for bolster plate mounting or press bed mounting with a hardened and ground pin pressure pad custom made to fit the entire press bed opening.

The cushion comes complete with combination pressure gauge, and all necessary fittings completely engineered to meet any press requirements.

The Dayton Rogers Mfg Co, Minneapolis 7, Minn

MORE DATA? Circle 136, inside back cover

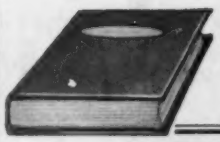
New Fixture Jacks Provide Variable-Height Pressure Stops

Fixture jacks that provide adjustable-height clamping for pressure stops on milling fixtures, drill jigs, and similar devices are designed to adjust to the irregularities of all milling operations and are manufactured in smooth, round head, or hardened-tool-steel serrated gripping surfaces.

Pin construction permits jack to elevate vertically without rotation. Outer diameters of bushing are ground for press-fit. Jacking limits range from 9/16 to 1½ in. on smallest jack to 1 to 3¼ in. on the largest.

Jergens Tool Specialty Co, 712 E 163rd St, Cleveland 10, Ohio

MORE DATA? Circle 137, inside back cover



Helpful books for your Professional Library

PRINCIPLES OF MANUFACTURING MATERIALS AND PROCESSES

Just Out. A practical guide to the selection and application of the most efficient and economical manufacturing process for virtually any specialized operation. By J. S. Campbell, Univ. of Calif., Berkeley. 668 pp., 459 illus., $9.75

THEORY OF METAL CUTTING

Just Out. Here are the essential facts on metal cutting processes to help you achieve better surface finish, rapid removal of metal, and effective machining practice. Covers mechanics of cutting, cutting tools and fluids, economics of machining, and more. By P. H. Black, Ohio Univ. 216 pp., 126 illus., $7.50

TOOL ENGINEERS' HANDBOOK

A monumental reference volume treating all phases of planning, control, design, tooling, and other operations involved in the mechanical processing of finished metals. Brings you a wealth of data collected from reliable sources. By ASTME, F. W. Wilson Editor-in-Chief. 2nd Ed. 2289 pp., 1709 illus., 605 tables, $19.50

SUCCESSFUL MANAGERIAL CONTROL BY RATIO-ANALYSIS

Just Out. Fully describes this tested method of analyzing and relating ratios—developed from company data and records—to provide accurate information for effective management, decision-making, and planning. By S. A. Tucker, Martin & Tucker. 434 pp., 191 illus., charts, and tables, $11.00

SMALL PLANT MANAGEMENT

Just Out—2nd Ed. Fills your need for up-to-date knowledge of management techniques well suited for application in small plants or technical service units. Describes and illustrates modern concepts, improved procedures of planning, organizing, operating and supervising. Prepared under the auspices of Mgmt. Div., ASME. Edited by W. A. MacCrehan. 2nd Ed. 560 pp., 43 illus., $10.50

FREE MAN AND THE CORPORATION

Inside views on the true relationship between the individual and the corporation, by one of America's leading executives. Discusses labor unions, influence of corporation life on creative talent, managerial techniques, etc. By R. M. Blough, Chairman, U. S. Steel Corp. 140 pp., $4.50

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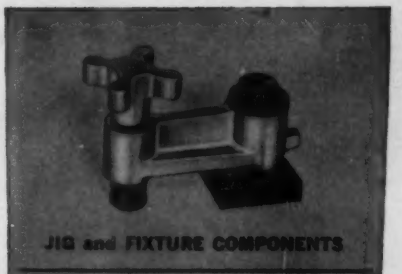

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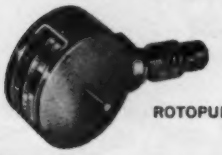

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NOW...Louis Allis offers DYNAPAR* Digital Control Systems!

Louis Allis can supply accurate digital controls designed to industrial standards for a wide variety of continuous process lines

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Dynapar's digital devices utilize precise pulses, and eliminate the drift inaccuracy inherent in magnitude-measuring analog systems. There's no need for constant calibration or adjustment. Pulses are reliably provided by rugged ROTO-PULSERS, highly stable sensing and pulse generating devices — visual indication is obtained by easily-read luminous direct numerical readouts. Control functions are accomplished by a variety of special devices tailored to specific operations. All DYNAPAR equipment features the most modern solid-state transistorized circuitry to provide long-life operation without maintenance.

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*Dynapar Corporation is the electronic subsidiary of The Louis Allis Co.

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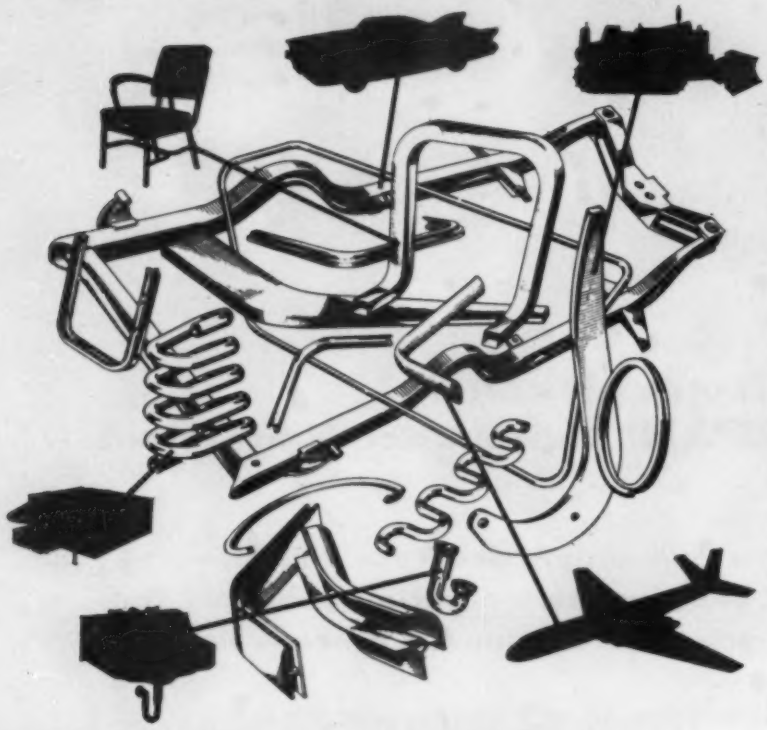
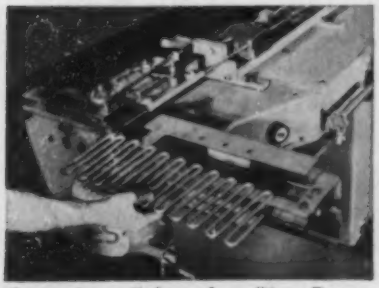


YOU CAN SAVE BY BENDING!

By production bending the "Pines-way," hundreds of metalworking plants are now benefiting from the cost-cutting advantages of cold-bending tubing, pipe, extruded or rolled shapes into parts similar to those above. Parts are produced faster, with smooth, strong bends. This means improved product quality at reduced costs.

A wide range of bending on large or small work, long- or short-run jobs, is easily accomplished by a complete line of standard Pines Bending Machines. Hydraulic power and automatic operation provide maximum accuracy, efficiency, and economy. Find out today, without obligation, how these machines can produce your parts at less cost.



Serpentine coil formed on Pines Rotary Machine at 900 bends an hour with 8% material savings, reduced assembly costs.

Tubular steel furniture frame is produced on a Pines Bending Press at the exceptional rate of over 2000 bends an hour.

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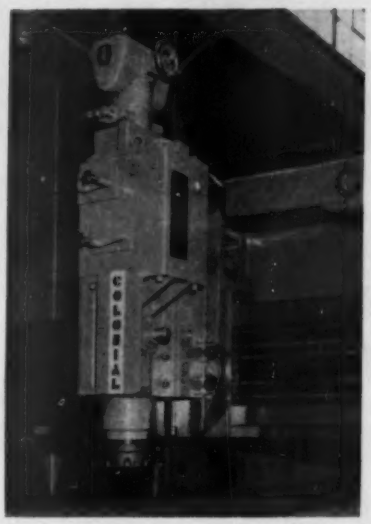


Colonial Broach Spindle Gives Constant HP Over All Speeds

This new hydraulic constant horsepower milling spindle is said to condense maximum horsepower into minimum size for easy conversion to either existing equipment or new setups.

The main feature of this spindle is that it has been designed so that torque increases in direct proportion to speed reduction. Result: constant hp regardless of speed selected. The company claims its new machine is compact enough to fit any designer's requirements while offering an infinite speed range, at rated hp, regardless of speed.

The new milling spindles are available with ratings from 10 to 50 hp as "standard"; smaller or larger units are also available.

Colonial Broach & Machine Co, Contour Mill & Spindle Div, 21601 Hoover Rd, Warren, Mich

MORE DATA? Circle 138, inside back cover

Chrome Plating Pellets Have Built-In Fume Suppressor

New fume-controlled compounds for decorative chromium plating solutions are said to reduce chromic acid losses and minimize loss of heat from plating plants. Under most operating conditions, fume suppression is maintained automatically and special additions are not necessary.

The new fume-controlled compounds—Unichrome SRHS (self-regulating, high-speed) CR-100F, CR-110F, CR-120F and CF-520F—come in pelletized form providing in a single product the necessary chromic acid, a plating "catalyst,"

and a chemical fume suppressor that acts as a built in ventilation aid.

Metal & Thermit Corp, General Offices, Rahway, N J—In Canada: M & T Products of Canada Ltd, 172 Belfield Rd, Rexdale, Ont

MORE DATA? Circle 139, inside back cover

New Metal Composition Promises High Temp, High Pressure Seals

A new material for use in high temperature, high pressure static seals is a composite of two metals for applications at temps up to 1200 F and pressures to 5000 psi.

The composites are made by impregnating a porous body of fiber metal — the skeleton — with a soft metal. Metals used are corrosion resistant for use with chemicals, exotic fuels or hydraulic fluids.

Illinois Inst of Technology, 35 W 33rd St, Chicago 16, Ill

MORE DATA? Circle 140, inside back cover

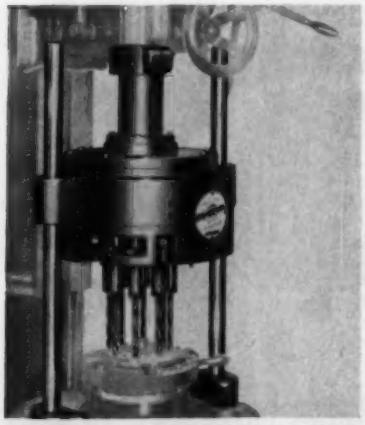
Quench Oil Eliminates Finishing

Voluta Oil 921, a new quench oil, is said to protect bright surfaces during rapid quench. Long service life of the oil is promised due to an exceptional resistance to oxidation.

Special additives in the oil are said to protect the bright finish and cleanliness of carbon and alloy steel surfaces to such a degree that in many cases it may be possible to eliminate finishing operations.

Shell Oil Co, 50 W 50th St, New York 20, N Y

MORE DATA? Circle 108, inside back cover



ADJUSTAFIX, A FIXED CENTER TYPE multiple spindle drill head, is said to be readily installed on standard and special machines. With very short overall length, the basic design provides a main drive box and a demountable pattern plate—*United States Drill Head Co, 5298 River Rd, Cincinnati 33, Ohio*

MORE DATA? Circle 123, inside back cover

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Eldorado Gun Drills are your best guarantee for excellent surface finish and top quality performance in gun drilling flawless, straight, round, accurately located holes at high speeds in one single operation. Each Eldorado Gun Drill is precision made to exacting specifications by gun drill specialists. Gun drill making is our business, our only business.

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OA Lengths	4" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Drivers	Std. or to fit you need	.750" dia. x 2 3/4" long	1" dia. x 2 3/4" long
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Three Different Tests Performed On Single Machine

Tensile, compression, and guided bend tests can all be made on Model TE-10-AS which has a capacity of 10,000 lb and is equipped with two gages to register the load applied in two ranges. Motor and hydraulic power unit are located within the base; controls are mounted on the front.

Guided bend testing, which consists of bending butt-welded samples that are originally flat into U-shapes at the welds, is performed in the compression testing area of the machine. When used as a tensile testing machine, the lower jaw holder is placed in one of the three sets of slots, to suit the specimen length. A variety of jaw inserts are available to hold specimens up to ½ in. thick by 1½ wide or ¾ in in dia. Machine shown will handle specimens up to 8 in. long. For compression testing, the guided bend fixture is replaced by a pair of hardened compression plates. Space available for testing is 9½ in. high by 8 in. between the vertical pulling rods.

Steel City Testing Machine, Inc, 8817 Lyndon Ave, Detroit 38, Mich

MORE DATA? Circle 141 inside back cover

Electronic Governor for DC Motors Offered for Heavy-Duty Operation

Electronic governor for precise speed control of shunt wound, direct current motors up to 1 hp maintains a constant motor speed at any selected value despite variations in load, line voltage, or motor temperature.

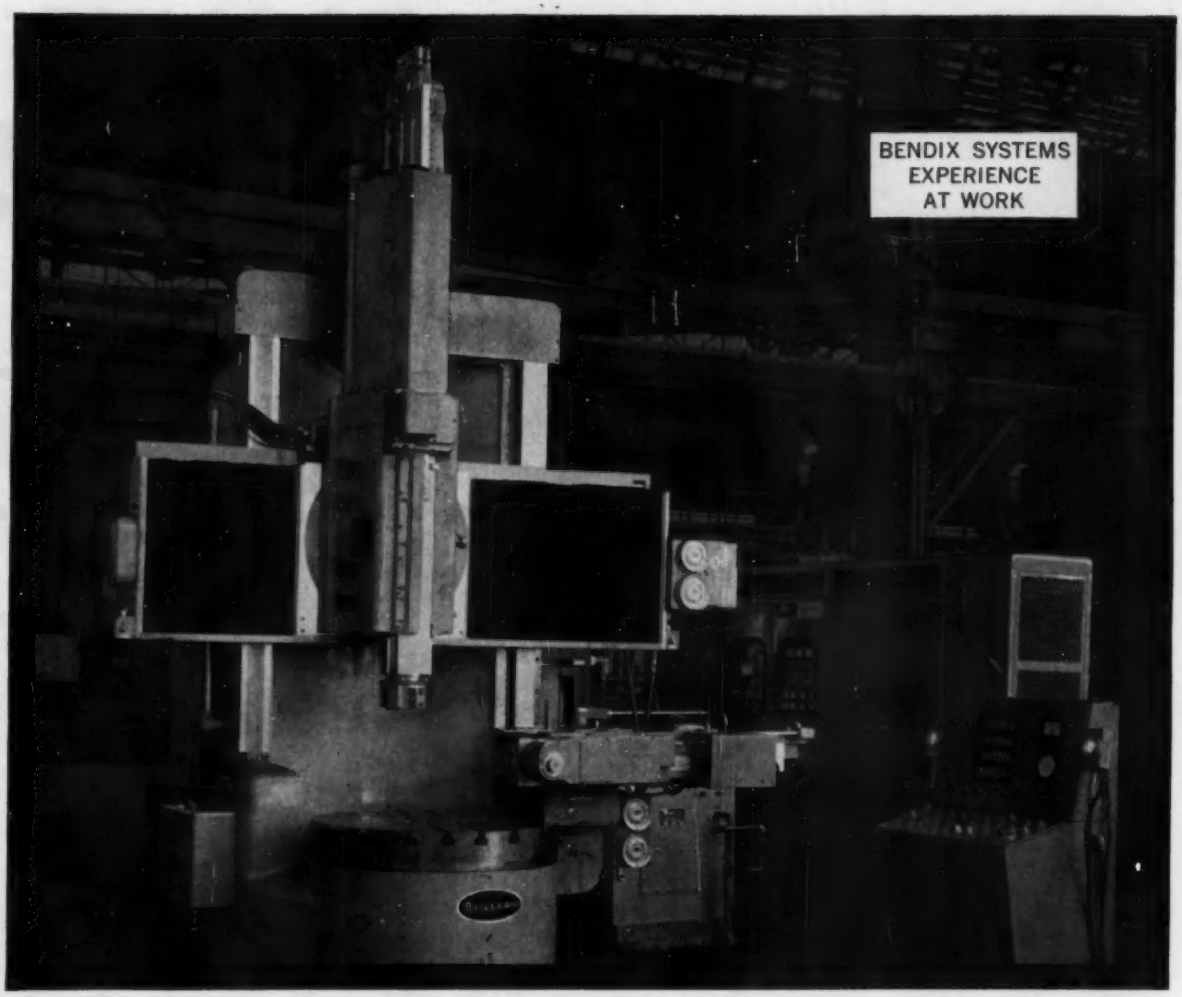
Operating from a 230-v 50-60-c single-phase line, the unit is available either as a stripped chassis suitable for incorporation into other equipment, as a rack-mounted unit, or as a self-contained unit enclosed in a cabinet.

Linde Co, Electric Welding Dept, 270 Park Ave, New York 17, NY

MORE DATA? Circle 142, inside back cover

AUTOMATIC TUB MILL STRIP WELDER has a working cycle of less than 25 sec. Result is a high-speed, high-strength, virtually invisible joint that can be left in the work—*National Electric Welding Machines Co, 1846 Trumbull St, Bay City, Mich*

MORE DATA? Circle 143, inside back cover



BENDIX SYSTEM ENGINEERING PROVIDES OPTIMUM NUMERICAL CONTROL FOR TURRET LATHE

Shown above is a Bullard four-axis vertical turret lathe equipped with Bendix DynaPath-14 contouring control unit. In this application, the selection of tools and spindle speeds is programmed, as is the motion of both slides.

Bendix application engineers, with accumulated experience in mechanical and hydraulic analysis of machine tools, worked closely with Bullard to produce this wedding of machine tool and numerical controls. And Bendix systems experience gained in working on other contour turning applications (with such companies as Ex-Cell-O, Heald, and Giddings & Lewis) assures the user correct application of control unit to machine tool.

In addition to contour turning applications, Bendix engineers numerical control systems for milling, grinding, drilling and jig boring machines. We have developed and applied controls to 2-, 3-, 4-, and 5-axis systems, both continuous path and point-to-point. These controls are being used daily in plants across the country to increase machine tool efficiency, reduce lead times, and make parts of consistently high accuracy.

Bendix SYSTEMS EXPERIENCE can provide the key to your machine tool problems. The right Bendix numerical control unit can be the profit-maker you've been looking for. Start putting Bendix application engineering experience to work for *you*—write today for a copy of our catalog number 308.

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KENDEX* *tailored* TOOLING

Two special heads, with modified Kendex holders, machine both sides of a stub eye simultaneously at American Coleman Company, Littleton, Colorado. Range of bore sizes can be machined by simply resetting tools.

Developed in cooperation with customer's engineers, the two special Kendex boring heads—with Kendex "throw-away" inserts—have increased production, reduced cost per piece and improved the product.

REASONS: Reduced initial set-up time from 3 hours to 30 minutes; eliminated the 5-hour tool regrinding job required after every 80 pieces. Instead of 3-hour set-ups, cutting edges are now indexed within ±.001 inch in 5 minutes. Saved—a full day's machine time for every 100 pieces.

Such IMAGINATIVE attacks on machining costs with Kendex Tailored Tooling are helping fight high costs in many plants. Applications shown at right may suggest operations in your plant where specially-designed Kendex tooling may combine two or more operations in one pass or help reduce machining costs in some other way.

Kennametal Carbide Engineers, trained to analyze tooling applications and backed by our headquarters staff of tooling specialists, are continually helping customers use standard tooling or design special tooling to reduce machine downtime and improve production.

To meet the growing demand for Kendex Tailored Tooling, our production facilities have been expanded repeatedly within the last several years.

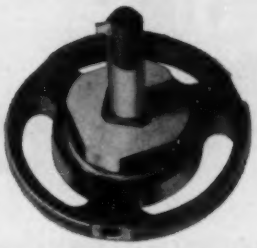
For full details about the Kendex Tailored Tools shown at right, plus many more, call your Kennametal Carbide Engineer. Ask him for our booklet "There's Profit in Retiring a Tradition" which gives dollars-and-cents facts as to how some companies have reduced machining costs as much as 70% with standard Kendex "throw-away" insert tooling . . . or write to KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark

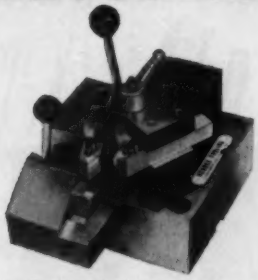
33591

increases production...reduces cost

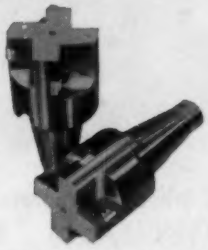
Boring Bar designed for mounting directly on machine tool turret in a gang tooling application. Dovetail mounting permits quick change of bore size.



Special K-Bar used for machining transmission cover. Design utilizes threaded construction to allow removal of solid carbide bar from flange.

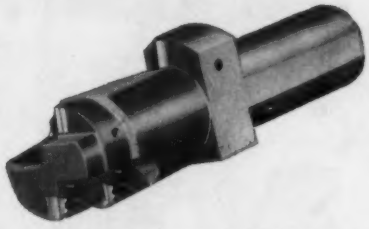


Special Facing, Skiving and Grooving Tool Block (rear slide) for machining transmission gear.



Special Milling Head for milling wrench slots (two flats for spanner wrench) on drill pipe.

Multi-Screw-On Kendex for machining rough throws on large crankshaft.

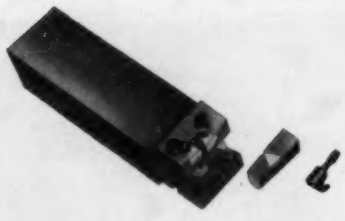


Special Multiple Insert Boring Bar with air coolant holes. Bores three diameters simultaneously.

K-Bar for tracing complex deep hole. High rigidity of Kennametal shank eliminates chatter.

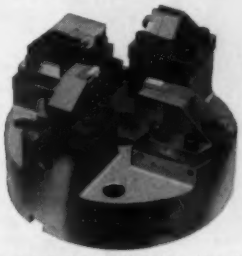
Special K-Bar with adjustable head for machining axle cross bores in differential carrier.

Special Hollow Milling Head for rough turning O.D. of bearing diameters, forming radius and chamfering of diesel tractor roller idlers.

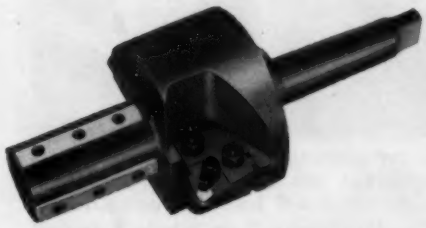


Multiple Insert Kendex Holder for facing and forming O.D. of oil slinger ring on crankshaft.

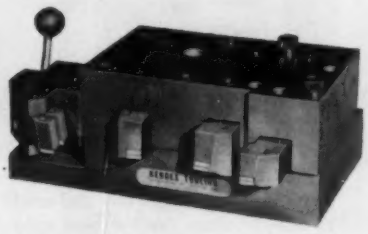
Special Kendex Holder for back facing gear plate of output shaft and planet carrier assembly through hole in gear blank.



Special Hollow Milling Head for finish turning O.D. of bearing diameters, forming radius and chamfering of diesel tractor roller idlers.



Boring Head for rough and finish boring of flywheel housing.



Rear Slide Tool Block for machining (finishing) gear transmission countershaft.

INDUSTRY AND
KENNAMETAL
...Partners in Progress

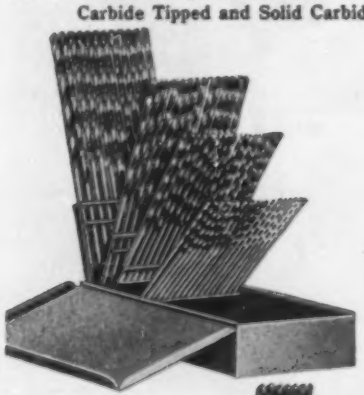
Toughest, hardest, strongest
. . . none finer at any price!

It pays to specify

ACE

DRILLS
REAMERS
BLANKS

Premium Quality High Speed Steel
Carbide Tipped and Solid Carbide



DRILL SETS

Standard Fractional, Wire and Letter series drills conveniently packed in folding indexed cases.

BLANK SETS

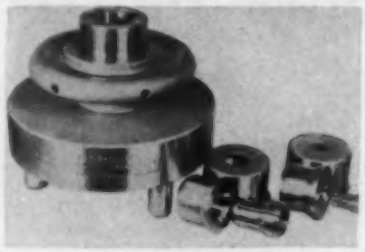
Consist of uniformly hardened high speed steel drill and reamer blanks—precision ground to new close tolerances.

Call your local distributor today—or write Ace direct for latest catalog and price information.

ACE DRILL
Adrian, Michigan

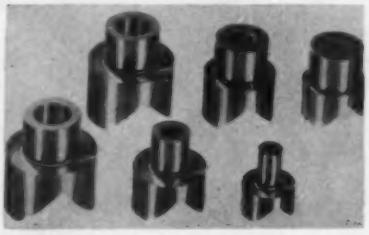
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

NEW SHOP EQUIPMENT



MODEL 501 COLLET CHUCK spans size range from 1⅝ to ¼ in. with 0.0005-in. accuracy. Two camming surfaces enable the collet to grip drills and end mills on their flutes as well as on straight shanks — *Erickson Tool Co, 34350 Solon Rd, Solon, Ohio*

MORE DATA? Circle 144, inside back cover



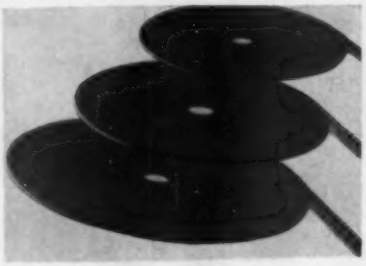
V-Bushing Liners Provide Automatic Self Centering

Hardened ground liners are designed for use with any type of cylindrical, square, or hex stock drilling, either custom fixture or standard fixture. Acting as a liner for removable bushings, it grooves itself dead center on stock to be drilled, permits center drilling even near the ends of bars.

Liners are produced in 2 sets of 3 bushings—one set of 3 with ¾-in. OD, and the other set with varying ODs. Both sets take slip bushings with ODs of 3/16, 5/16, and ½ in. in a range from No. 80 drill to 11/32 in. in ASA or Acme standard sizes.

Acme Industrial Co, 200 N Laflin St, Chicago 7, Ill

MORE DATA? Circle 145, inside back cover

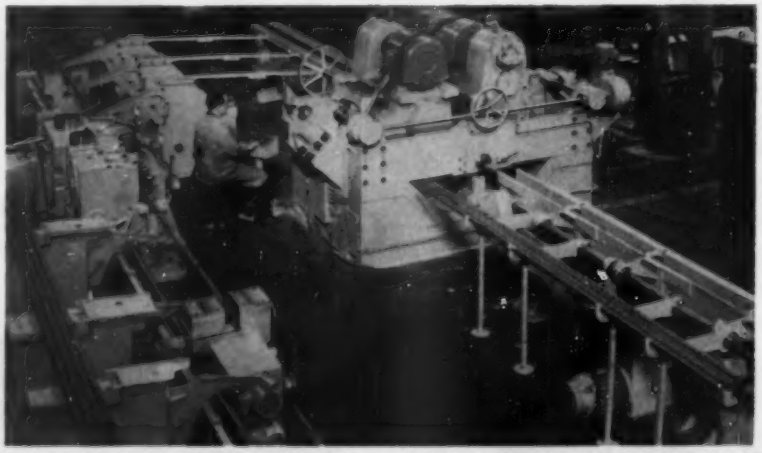


Cutoff Wheel Incorporates Triple Cutting Action

The Sharp-Sided (SS) Cut-Off Wheel features cutting action on both sides as well as the face of the wheel. Three-sided abrasive action reduces heat-producing, metal-burning friction. Because the wheel actually grinds its own clearance, a faster cut is produced with less burn and burr. Reduction of heat also minimizes wheel wear and permits use of a harder wheel for substantial savings in wheel costs.

American Emery Wheel Works, 1 Richmond Sq, Providence, RI

MORE DATA? Circle 146, inside back cover



KIESERLING CENTERLESS bar turning, straightening, and polishing machine is arranged for completely automatic operation with only one operator. Made in several sizes, the machine removes the rough skin from bars and turns the black into finished bars of finished size. It is fitted with an automatic loading and discharging device—*Dist by Straus-Autys Corp, 45 No Station Plaza, Great Neck, NY*

MORE DATA? Circle 147, inside back cover

Rheem Electronics
NUMERICAL POSITIONING CONTROLS

Reduce lead time ■ Improve product quality ■ Eliminate expensive jigs and fixtures ■ Increase machine productivity Reduce scrap loss ■ Make small lots economical ■

VERSATILE!

one system fits many machines offers savings in operator training, planning, maintenance

Rheem Numerical Positioning Controls may be applied to almost all machine positioning requirements.

Construction is modular, by axes.

Different resolutions are available.

Automatic, semi-automatic, or manual operation modes are available.

Decimal display of tape information is provided.

Positioning speeds are high... limited by resolution only.

Feed rate control is available.

Travel distances are large.

Controls from 1 to 6 axes.

Electronic distribution.

Manual input of dimensional information and decimal display available at no extra cost.

Let versatile Rheem Electronics Numerical Positioning Controls start saving you money. Write TODAY!

TYPICAL TWO-AXIS RHEEM NUMERICAL POSITIONING CONTROLS CONSOLE. THIRD AXIS AVAILABLE AT LOW COST.

RHEEM Position Display

POSITION DISPLAY

Designed to meet the requirements of operator controlled machines including retrofit on existing machines... provides a continuous display of machine position in decimal form... used in conjunction with a position transducer to detect machine slide displacement in increments of either .001 or .0001 inches... offers selection of absolute position from a zero reference point continuously displayed, or the incremental distance between two coordinate positions... allows the operator to position the machine more rapidly and with greater accuracy... a compact unit occupying less than one cubic foot of space per axis.

RHEEM NUMERICAL CONTROL shown with Burgmaster 2SANT turret drilling machine

RHEEM NUMERICAL CONTROL pictured with Excello Model 780 Numera-trol boring machine

Rheem electronics *A division of Rheem Manufacturing Company*

5200 West 104th Street
Los Angeles 45, Calif. SPring 6-1800

"Get rid of that DUST!"

"The boss was sore and I was on the spot.

"He shoved the report from the efficiency engineer at me. I read it: 'Yearly loss due to machine wear, misalignment and down time . . . $3,000. Major cause . . . abrasive dust.'

"The boss pointed his finger at me, 'Get rid of that dust and get rid of it fast!' "

Now, it was my problem, and I was on the spot.

"First thing I did was to check into a central dust collecting system. But the lowest bid I could get was $8,000. Too much.

"Then I came across a Torit ad, offering economical portable dust collectors.

"Two days after my call Torit engineers showed me how in only one week they could install a portable, unitized Torit Dust Collector at each of our eight grinders, trapping dust right at its source—cleaning the air throughout the entire plant.

"Total cost? Only $2400.00. That's a $5,600.00 saving over the lowest priced central system.

"You guessed it—we installed the eight Torit Collectors."

Torit solved my problem

"This year when we received our report it read: 'Loss due to machine wear, misalignment and down time...$340.00.' A saving of $2,660.

"This time the boss was all smiles. He slapped me on the back, 'Charlie, you did a fine job getting rid of that dust. Frankly, I didn't think it could be done with such a small investment.'

"Now there's a pretty nice fellow to work for.

"If you've got a dust problem, or are about to have one, write the Torit people. They've manufactured and sold more dust collectors than anyone else in the U.S.A. Chances are they can help you the way they helped us."

TORIT manufacturing company

Dept. 411, 1133 Rankin St., St. Paul 16, Minn.

NEW MATERIALS

New Parting Agent Aids Better Molding Of Epoxies, Polyesters

A new parting agent is said to enable more efficient casting of epoxies and polyesters. Called Parting Agent EP, it is claimed to reduce molding time and produce better casting finishes. Features of film produced by using the new agent are:

- Fast drying,
- Good adhesion to irregular and sharp contours,
- Surface tension that covers minor mold defects,
- Simple removal by stripping or warm water wash.

Two types of the agent are available: one, of bright fluorescent color to facilitate control of parting film thickness; the other, colorless to eliminate the need of film removal.

Parting Agent EP is water soluble meeting spray gun requirements, and is supplied in one, five, and fifty gal containers.

Schwartz Chemical Co, Inc, 50-01 Second St, Long Island City 1, N Y

MORE DATA? Circle 68, inside back cover

New High Speed Steel Expected To Increase Tool Life, Speed

A high speed steel, Rex 49, has been designed to provide greatly increased tool life in machining hard-to-cut metals. In tests it has out-performed the more expensive high cobalt and high vanadium high-speed steels. Use of Rex 49 is expected to eliminate the need for many types of tool steels now in use and increase tool life two to four times.

Having a base price of $2.07 per lb, the new steel can be heat treated to Rh 67 to 69 C. When used to cut normal materials, it is expected to permit increases in speed, feed, and depth of cut.

Crucible Steel Co of America, Pittsburgh 22, Pa

MORE DATA? Circle 69, inside back cover

High Heat Paint Good to 1700 F

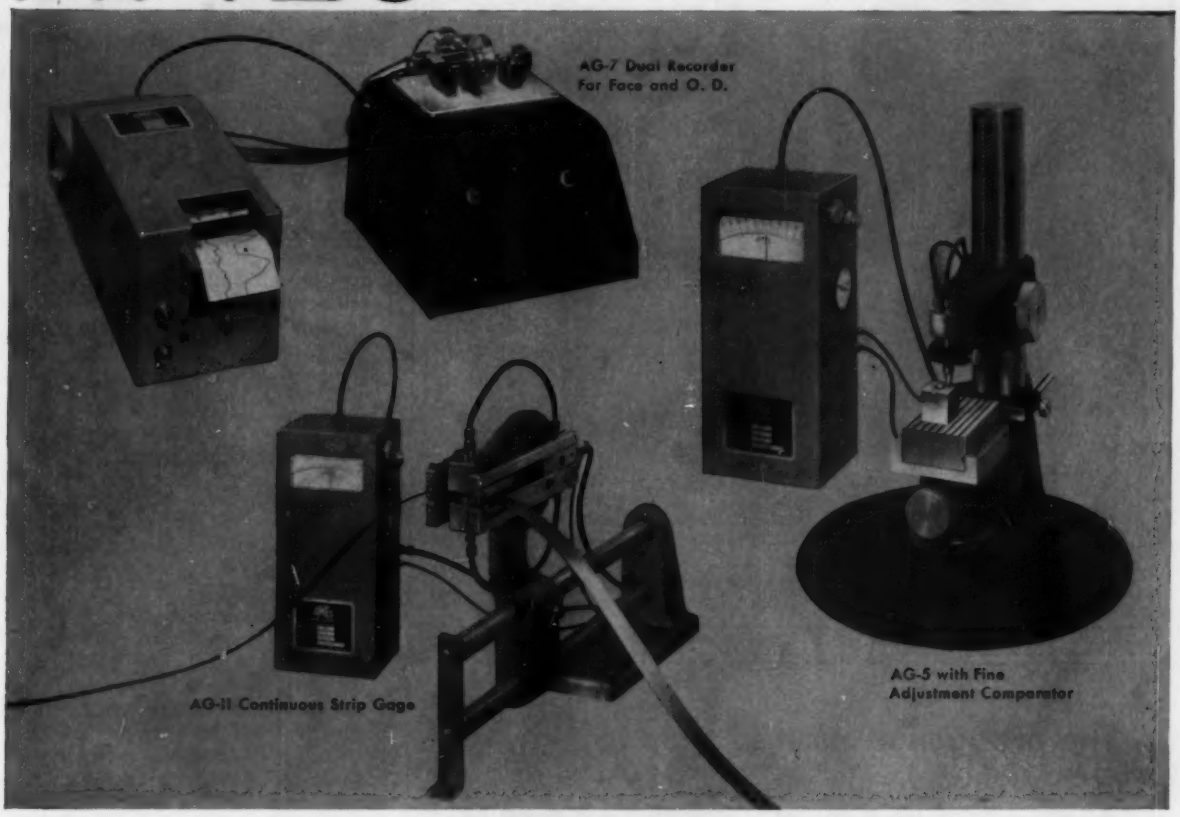
A new line of extra-high heat paints is said to be capable of withstanding temperatures up to 1700 F without blistering or burning. The paints are composed of a clear silicon base blended with an aluminum pigment.

After application by brush, spray or dip, the paint air-dries to a bright finish in approximately 30 min. Especially recommended for temperatures in excess of 500 F, it is said to virtually fuse with the surface it is applied to when submitted to heat.

Chem Industrial Co, 3784 Ridge Rd, Brooklyn 9, Ohio

MORE DATA? Circle 70, inside back cover

AMES *Masters of Measurement*



ACCU-FLOW AIR GAGING EQUIPMENT

The new line of ACCU-FLOW air gages developed by B. C. Ames includes several patented components, including nozzles and pressure indicators, which give these gages unusual range and exceptional linearity.

Special Models are Available for Checking: outside and inside diameters, center distances, flatness, roundness, hole depths and continuous non-contact measuring or comparing of paper, metals, plastic films, etc.

Ames ACCU-FLOW Air Gages are providing the answer to many measuring problems that were once considered impossible to solve. For complete information on the entire line of Ames air gaging equipment, write for new ACCU-FLOW folder. *You're asking for the best when you specify Ames!*

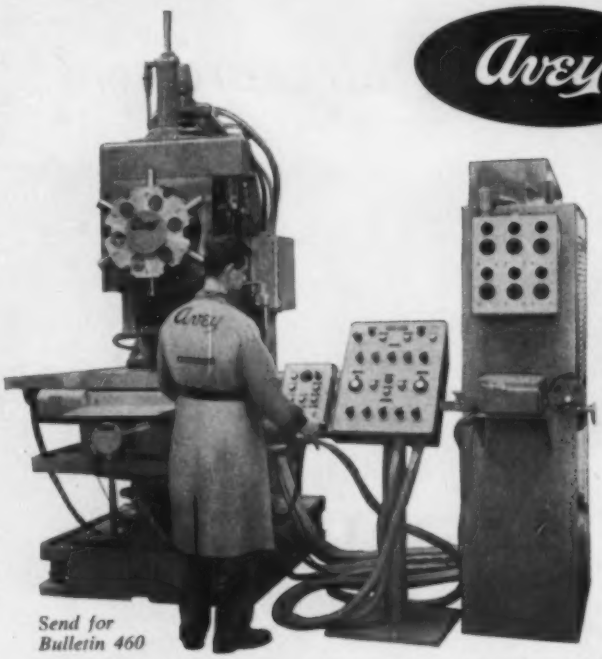
B. C. AMES CO., Waltham 54, Mass. Representatives in Principal Cities—
In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton.

B.C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS

6 precision spindles by

Avey



Send for Bulletin 460

You can get this rugged Avey 250 Turret-Dex with either automatic or numerical controls. Rotary, 2- or 3-axis positioning. Pre-selected speeds, feeds, rapid advance, tapping cycles. Automatic depth control all spindles; automatic turret clamp; positive spindle stop; skip index. Capacity to 1¼". Eight spindles optional. Avey, Box 1264, Cincinnati 1, Ohio.

CIRCLE 329 READER SERVICE CARD

The production man's guide to

Fastening Devices

Knowing how to put a product together is one of the keys to efficient production. Quick, inexpensive machining and forming techniques are wasted if slow, cumbersome and inefficient assembly methods are used. This Special Report summarizing typical mechanical fastening devices will help you select a fastener that will lead to a more dependable, more economical product.

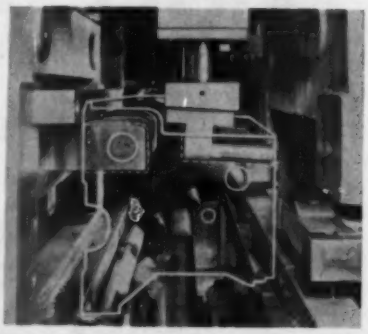
16 pages, fully illustrated — 35 cents per copy

Reader Service Department

American Machinist / Metalworking Manufacturing

330 West 42nd Street **New York 36, N. Y.**

NEW SHOP EQUIPMENT



SUPERIMPOSED OUTLINE shows how probes check castings during processing of cylinder blocks for a four-cylinder engine. Castings in which probes will not fit are withdrawn from line at the next station so work will not be wasted on them—*Cross Co, Park Grove Station, Detroit 5, Mich*

MORE DATA? Circle 148, inside back cover

Special Wrenches Supplied In Any Size or Shape

Wrenches and similar hand tools, furnished to custom design and specifications are available in production quantities at less than the cost of forging or castings. Any jaw configuration can be flame-cut economically because no tooling, dies, casting patterns, or templets are required. Special wrenches and tools can be flame-cut out of plain carbon steel or many alloy steels, in any thickness from ¼ up to 28 in., in any quantity from one to thousands.

Reliable Steel Plate Co, 2330 E 79th St, Cleveland 4, Ohio

MORE DATA? Circle 149, inside back cover

UTILITY MICROSCOPE, is furnished in two models, one 20X, the other with 10, 20, and 40X, it provides erect image, wide field of view, and a fixed long working distance of 4 in. for inspection or measurement of small parts or critical work. It can be attached to almost any type of machine, bench, jig, or fixture—*American Optical Co, Instrument Div, Buffalo 15, NY*

MORE DATA? Circle 150, inside back cover

VALUE ANALYSIS FACT SHEET

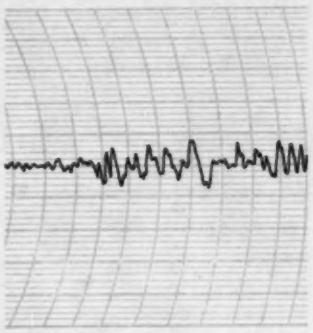
Formbrite Drawn Brass Parts

How to open finishing room bottlenecks and cut polishing costs up to 50%—produce stronger, more scratch-resistant parts—and get additional savings —with Formbrite, superfine-grain drawing brass.

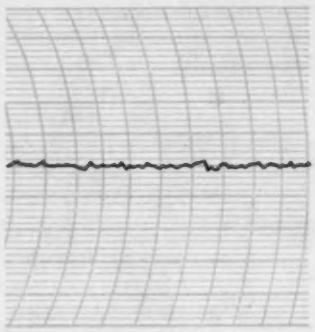
Very often in the production of drawn brass parts which are to be plated or lacquered, finishing costs are greater than those of all preceding operations —or even the cost of the metal. Under any circumstances, they are a high percentage of total costs.

Furthermore, parts go through the pressroom a lot faster than they can through the finishing room, creating bottlenecks in production.

ENLARGED SURFACE TRACES at the right prove that you can lick both cost and time problems with Formbrite®, Anaconda superfine-grain drawing brass. Savings in polishing costs reported by users run from 40 to 50%. These are net savings, as Formbrite costs no more than ordinary drawing brass.

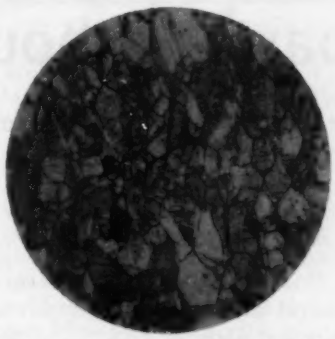


Enlarged surface trace of standard drawing brass (grain size, .045 mm) after 40% elongation. This kind of roughness causes "orange peel" effect in the working of standard drawing brass. Smoothing such mountains down to the valleys takes considerable cutting.



Enlarged surface trace of Formbrite drawing brass (grain size, .005 mm) after 40% elongation. Surface smoothness after deformation is the test of a drawing brass's polishing characteristics. It is relatively easy to level these little hills on the surface of Formbrite. In many cases, users find they eliminate cutting operations altogether, need only a simple color buff.

STRONGER, MORE SCRATCH RESISTANT. Formbrite is stronger, harder, springier than the usual drawing brasses in the same standard tempers, yet retains remarkable ductility for forming and drawing, and takes sharp, clean-cut ornamental die impressions. The harder surface means fewer rejects from scratching and marring during handling. In some instances, the superior strength and hardness of Formbrite make possible the use of a thinner gage metal, with an additional saving in material cost.



This is the microstructure, shown 75x, of the standard drawing brass used above.

This uniform superfine-grain structure of Formbrite, shown 75x, is produced by special procedures for rolling or drawing and annealing developed by Anaconda American Brass Company.

SIZES AND TEMPERS. Brass manufactured by the Formbrite method, with its special characteristic of superfine-grain structure, is supplied in standard Formbrite temper, half-hard, three-quarter-hard, hard, and extra-hard tempers, and can be rolled in heavy coils to .004" in thickness by 24" wide, weighing 100 pounds per inch of width. The table below gives physical data and terminology for Formbrite tempers.

ALLOYS. In addition to 70-30 brass, the following Anaconda alloys also are produced by the Formbrite method: Yellow Brass-59, Gilding Brass-4, Commercial Bronze-14, Red Brass-24, and Low Brass-32.

TECHNICAL ASSISTANCE. For help in selecting the alloy and temper to handle your particular job—for a copy of Publication B-39 with more details about Formbrite—see your Anaconda representative. Or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 6145

TERMINOLOGY FOR FORMBRITE TEMPERS

TENSILE STRENGTH LB. SQ. IN.		ROCKWELL B HARDNESS		DESIGNATION TO BE USED
MIN.	MAX.	MIN.	MAX.	
49,000	59,000	40	65	Yellow Brass—Formbrite
57,000	67,000	60	77	Half-hard Yellow Brass—Formbrite
64,000	74,000	72	82	Three-quarter-hard Yellow Brass—Formbrite
71,000	81,000	79	86	Hard Yellow Brass—Formbrite
83,000	92,000	85	91	Extra-hard Yellow Brass—Formbrite

FORMBRITE

Superfine-grain drawing brass

a product of

ANACONDA®

Anaconda American Brass Company

CIRCLE 331 READER SERVICE CARD 233

DATA
10 units with 17 spindles
60-inch index table
9 rotating work fixtures with automatic clamping
450 parts per hour gross

This one Kingsbury operates on two different parts without changeover

Parts may be fed at random
This center column machine works on the two different parts shown with no changeover. The work fixtures hold either part without changing locators. Each fixture rotates 120° with each index of the table so the horizontal units can perform three sets of operations equally spaced.

Two of the vertical units drill two holes, one in each part. One unit drills Hole A in the bottom of the large part when its flange trips a micro switch. The other unit cycles every time, drilling Hole B in the top of the small part, "cutting air" in the large one.

You can make money with a Kingsbury. Here's how:

— One Kingsbury replaces several general purpose machines, saving space and labor.

—You cut work-in-process inventory by eliminating several banks of parts.

—You cut maintenance costs. Because of good basic design and rugged, accurate construction Kingsbury machines have run year after year, through millions of cycles, without serious trouble.

—Your machine can go right into your production line because our test runs before shipment guarantee uniform parts that gage.

May we make a proposal? Kingsbury Machine Tool Corp., Keene, N. H.

KINGSBURY

3 Horizontal Radial Units with Milling Heads
MILL 3 GEAR POCKETS 120° APART WITH 3.12. DIAM. CUTTER

3 Horizontal Units 45 Left of Radial Centerlines
DRILL 3 PAIRS OF HOLES 120° APART

2 Vertical Units
DRILL HOLE A
DRILL HOLE B

2 Vertical Units on Center Column
.563 CORE DRILL 3 HOLES
END MILL 3 PLACES

ALUMINUM PLANET PINION CARRIERS FOR AUTOMATIC TRANSMISSION

Ex-Cell-O to Build Machines For SIF Electrochemical Process

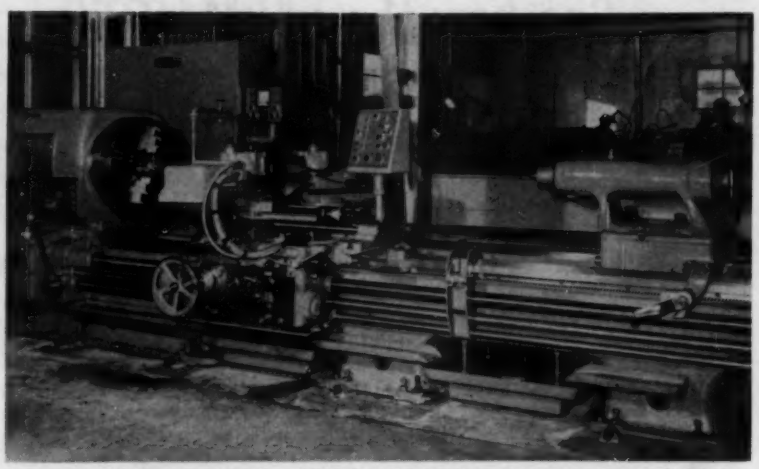
Steel Improvement & Forge Co, Cleveland, and Ex-Cell-O Corp, Detroit, have concluded an agreement whereby Ex-Cell-O has exclusive rights to build and market in the US and Canada new metalworking machines that utilize Steel Improvement's electrochemical processes (*AM/MM*—Nov 14, '60, p113). SIF will produce and market the electrolytic solutions used in the new metal-removing method and will continue its program of research and development on the chemical processes involved. Both companies will use the electrolytic machines in their own operations.

The electrochemical operations performed are similar to milling, drilling, sawing, contour turning and other processes used to shape metal parts on conventional machines. In the new metal-removing process, which was developed from research sponsored by SIF at Battelle Memorial Institute, the parts to be machined, and the electrodes, are held within a chamber through which a chemical solution flows. An electric current passing through the fluid from the workpiece to the electrodes removes the metal. There's no metal-to-metal contact between the work and the tool, and no tool pressure as with conventional machining processes. Rate of metal removal is governed by amount of current applied and varies with the type of metal to be machined and the work area to be covered.

Vascoloy-Ramet Forms European Company

Vascoloy-Ramet Corp, Waukegan, Ill, subsidiary of Fansteel Metallurgical Corp of North Chicago, has formed Vascoloy-Ramet (Europa) N V. The new company has broken ground for construction of a manufacturing facility in Zwolle, Holland, and the plant is expected to be in production by July.

The European firm has been established as a separate and distinct organization from its American counterpart, has its own management and sales staff, and will manufacture and distribute V-R products (cemented carbides and Tantung cast non-ferrous alloys) throughout Free Europe, the Scandinavian countries, and Great Britain. The new company is a subsidiary of Fansteel A G which was recently incorporated in Switzerland by Fansteel Metallurgical to gain a stronger competitive position in international markets.



Automatic single-point threading lathe installed at Alberta Oil Tool Co Ltd, Edmonton, Alberta, is designed primarily for automatic blanking and threading of drill stem connections. Reported to be the only one of its kind in the world with this combination of hydraulic principles, it is the result of four years of design engineering between the manufacturer and Oil Tool's engineering staff. Lathe was assembled for final tooling in Hanover, Germany, and displayed there during the German International Machine Tool Exposition last September.

Rohr Gets $9 Million in Orders

Three follow-on orders for aircraft components totaling over $9 million have been received by Rohr Aircraft Corp, Chula Vista, Calif. Contracts, from Boeing, Lockheed, and McDonnell, bring the company's backlog to more than $175 million. All of the products listed currently are being manufactured and the new orders are extensions of production schedules.

Hiring to be Upped by Ford And North American

Ford Motor Co reports that it will add 1300 new workers this year to the present 2100 staff at its Aeroneutronic Division at Newport Beach, Calif. Division is processing Defense Department contracts in weapons and space systems, advanced electronics, and data processing systems.

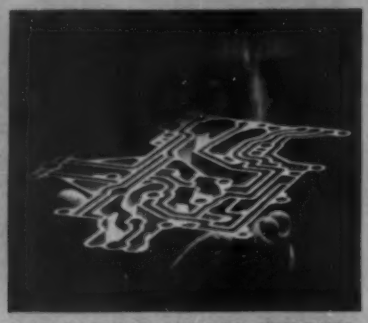
North American Aviation's plans call for addition of 2000 workers among its six divisions. Big bulk of the hiring will be at the Autonetics

McGIRK'S WORKS
by GEO. CRENSHAW
I'M SURE GETTIN' TIRED OF WALKING BACK AND FORTH WITH THESE PICKET SIGNS.
STRIKE
STRIKE
YEA! WE'VE BEEN AT IT SO LONG, I'VE LOST COUNT OF THE DAYS!
STRIKE
STRIKE
DO YOU THINK THEY'LL EVER GET THE STRIKE SETTLED?
STRIKE
STRIKE
McGIRK'S WORKS GATE A
MOE'S CORNER
If picketers are tryin' to get a SQUARE deal, why d' they always walk in CIRCLES ??

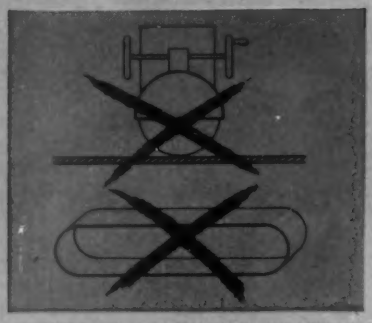
Aluminum Problems?

See how the LAPMASTER can lick 'em...

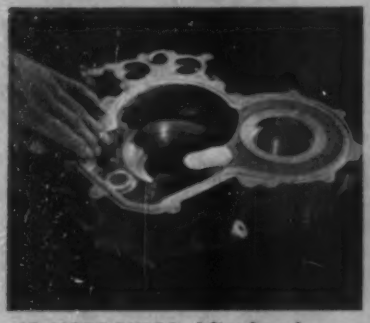
CLAMPING ELIMINATED. Aluminum, magnesium and all non-ferrous metals can't take clamping without warp or distortion. The Lapmaster eliminates this serious problem because flat surfaces are lapped in a free, unclamped state. Flatness checks show that the Lapmaster *consistently* produces surfaces to extremely close tolerances... even irregularly shaped parts, like those above, pass the most rigid inspection for flatness.



"AS-CAST" WARPAGE REMOVED FAST. Lapmasters quickly rectify "as-cast" warpage on flat surfaces of non-ferrous metal parts. Lapping produces the true, flat reference plane desired for subsequent machining. In other instances where parts become distorted due to clamping and chucking operations, a short, follow-up cycle on a Lapmaster will return the surfaces to their original flat condition.

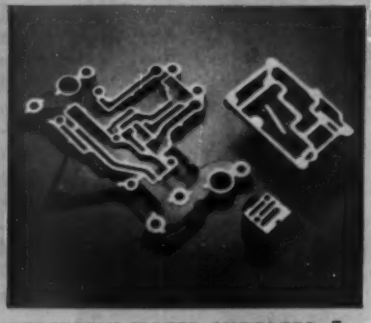


GRINDING PROBLEMS VANISH. There is no such thing as "lap plate loading". If you've tried grinding or belt sanding aluminum or magnesium, you know how fast the wheels load... how difficult and costly it is to prevent surface gouging, ripping or tearing. But with the Lapmaster method of stock removal, you never face such problems. Instead, you get uniform accuracy and a scratch-free finish, piece-after-piece.



NO MORE BURRS. After lapping on a Lapmaster, burrs just don't exist. Finger testing proves it every time. Lapping eliminates the expense of subsequent hand deburring operations and helps reduce inspection costs. This advantage is especially important in the finishing of pump, compressor or engine parts or on parts incorporating "O" ring groove on the face.

FAST STOCK REMOVAL. Lapping of non-ferrous metals on a Lapmaster is a finishing method that saves time and money for hundreds of manufacturers. Stock removal rates are high. Other methods requiring expensive tooling still cannot match the accuracy of lapping. And Lapmasters do it right the first time, every time.



PERFECTLY MATED SURFACES. In many cases, Lapmasters eliminate difficult gasketing problems by lapping mating surfaces to microinch finishes of 2 to 3 AA, to flatness within one light band (.0000116") or less and parallelity of exacting tolerances. The Lapmaster, for example, produces mating surfaces on aluminum transmission parts that will hold oil at 200 psi. Its uniform accuracy also eliminates selective assembly.

Lapmaster®

...THE MACHINE THAT PUT PRECISION LAPPING ON A PRODUCTION BASIS

Write for the complete Lapmaster catalog of facts and money-saving ideas.

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In England: Payne Products International, Slough Bucks.

Division which is working on the Hound Dog and Minuteman missiles, and in the stepped-up B-70 bomber program.

Big Plant for Tennessee

Ross Gear & Tool Co, Lafayette, Ind, will build a 240,000 sq-ft plant on a 40-acre site at Lebanon. Construction of the facility which will manufacture steering gear columns for autos, trucks, and tractors, will be financed by a $2.4 million industrial bond issue by the city.

Willys Not for Sale

Recurring reports that Willys Motors will merge or sell its business to American Motors Corp have been denied by President S A Girard who states that the company is not negotiating with any firm, and is not for sale. Mr Girard confirmed, however, that Willys and American are discussing the possibility of a joint engine facility in Mexico where both companies have assembly plants.

Tool Research Establishes New Metals Division

Assets of Utility Metal Products division of Young Spring & Wire Corp have been acquired for cash by Tool Research & Engineering Corp of Beverly Hills, Calif. The new Pasadena facility of approximately 120,000 sq ft will operate as the Exotic Metal Products division of TR, specializing in machining and fabrication of titanium, beryllium, tantalum, zirconium, and similar metals

"He dropped his safety button, then slipped on it"

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2. LEVEL 3. LICK VIBRATION

NEW LEVEL-RITE SERIES 500

Cut machinery installation time and costs up to 70, 75, even 80% . . . eliminate transmitted vibration up to 85%! That's the money-saving move with Level-Rite Series "500" — latest member of the Unisorb family. No lagging, no cement, no drilling, no "hit or miss" spotting is needed. Unisorb Level-Rite mounting is fast — machines can be moved and relocated quickly and with a minimum of downtime.

Level-Rite Series "500" is a self-contained leveling mount for light and medium duty machine shop tools. It withstands weights up to 750 lbs. Send for literature.

SPECIAL ADVANTAGES: Fast, simplified, precise leveling • Free-floating screw post — compensates for uneven floor • Safe, sure grip — can be cemented if needed • Lowers noise level — increases worker efficiency • Better machine performance (improved alignment) • Available in many types and thicknesses for all machine types • Money-back trial is yours for the asking.

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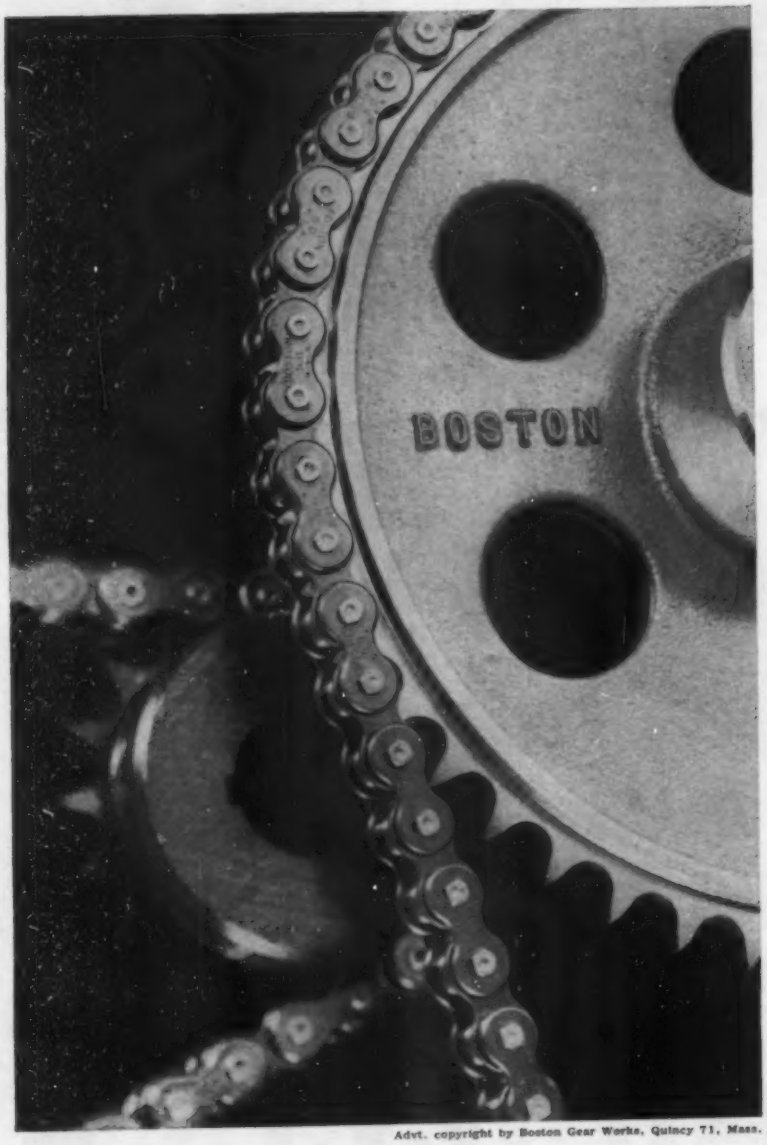
sprockets and chain



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Off the shelf – at factory prices.
For any chain drive 1/4″ to 2″ pitch –
Roller, Block, Ladder. See Catalog 57.
Design around the quality leader.

BOSTON Gear®

IN STOCK at your nearby DISTRIBUTOR

for supersonic aircraft, missiles, and space vehicles. The new division has contracts and is currently producing missile carrying vehicles for the Navy as well as structural components for commercial jet aircraft and missiles.

GE Gets $4.5 Million Satellite Job

A $4.5 million contract for construction of two Nimbus meteorological satellites has been awarded to the General Electric Co's Missile and Space Vehicle Department in Philadelphia. It's the second contract to go to GE for the Nimbus weather eye; two days before the new order, it received a $1.5 million award for design and development of a control and stabilization system for the satellite.

Bell Intercontinental Expands

Cincinnati Galvanizing Co, 56-year-old producer of galvanized household and commercial products, has been bought by Bell Intercontinental Corp in its first acquisition since the company was organized last summer. The firm will continue operation as an autonomous division. Sales of the Cincinnati company have averaged $3.5 million annually over the last five years. Bell Intercontinental was formed in July 1960 after Bell Aircraft sold its defense assets to Textron Inc. Corporate headquarters are now maintained in South Bend, Ind.

Stanley Alters Division Name

Stanley Electric Tools, division of the Stanley Works, New Britain, Conn, has changed its name to Stanley Power Tools. Since the division was set up in the late 1920's with the original manufacture of drills, screwdrivers, and grinders, it has expanded into lines of electric planers, routers, saws, sanders, hammers, and metalcutting shears. Products and the types of power used to operate them have become highly diversified. Today the division makes electric, high-frequency and, most recently, airpowered portable tools.

Republic Gets NASA Contract For Metals Study

Study contract for investigation of the use of electrical discharge to form high-strength metals has been received by Republic Aviation at Farmingdale, Long Island. Contract

came from Marshall Space Flight Center, the National Aeronautics and Space Administration's facility at Huntsville, Ala.

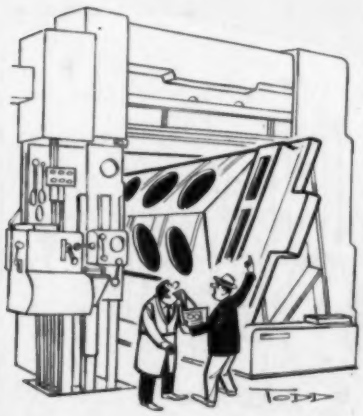
Two basic methods will be compared as to efficiencies in shaping stainless steel and aluminum alloys. The first involves the deformation of a metal workpiece by shock waves created in a liquid medium. In the second method, known as inductive repulsion forming, an induction coil is placed in close proximity to the workpiece and insulated from it. During the electrical discharge, opposing currents in the coil and metal produce a magnetic force that repels and deforms the metal away from the coil.

Honeywell Buys 48-Acre Tract

Purchase agreements have been signed by Minneapolis-Honeywell's Electronic Data Processing Division for acquisition of about 48 acres of land in the Boston suburb of Billerica to take care of future expansion. Present plans call for start of a 75,000 sq-ft manufacturing plant, the beginning of a complex, on the tract by midsummer with occupancy scheduled for the middle of next year. The structure will be designed to accommodate up to 650 employees. Employment in the EDP division has increased from 850 in January 1960 to over 3000 now.

Production Machine Moving

Operations of Production Machine Co, manufacturer of centerless grinders and polishing machines, will be moved from Greenfield, Mass, to Providence, RI, sometime this spring. Wanskuck Co of Providence, the parent firm, says the move is being made to consolidate and economize on operations.



"Someone read the scale wrong! It's ¼ inch equals an inch, not a foot."

BOSTON Gear® QUALITY

bored-to-size pinions

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86 sprocket pinion sizes with 360 bore sizes.
From local stock. Ready to install.
Off the shelf – at factory prices.
Complete with keyway and set screw.
Save machining cost. See Catalog 57.

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Clark Hardness Testers are *guaranteed* accurate for all "Rockwell Testing". Clark's exacting workmanship in the production of penetrators, testing blocks, anvils, and other accessories pays off in exceptional accuracy on the job. No wonder the low cost surprises our first-time customers. *Clark Instrument, Inc., 10201 Ford Road, Dearborn, Mich.*

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All information about hardness testing in easy-to-read text with many illustrations. Just write "Send Book" on your letterhead. Description and prices for Clark Hardness Tester and free Hardness Conversion Chart also available on request.

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Missile-Age Accuracy

Carborundum in the Bush

Carborundum Co of Niagara Falls plans to put up a million-dollar coated abrasive manufacturing plant in Melbourne, Australia. It'll be equipped with the most advanced facilities in the industry and will provide its products to Australia and New Zealand. Carborundum Australasia Pty Ltd, a subsidiary, now operates a plant in Sydney; its manufacturing operations will be transferred to the new facility when it's completed late this year.

$12 Million Order to Aerojet

Aerojet-General Corp, Azusa, Calif, has received a contract totaling $12 million from Lockheed Missiles and Space Division for additional R&D work on the AF's Midas infrared subsystem. To handle this expanding program, and Midas requirements that are expected to continue for the next five years, Aerojet is building a $1.25 million test and manufacturing facility at the Azusa plant.

American Motors' Canadian Plant Designed for Flexibility

New $3.5 million plant of American Motors (Canada) Ltd in Brampton, Ont, is described as the most modern automobile facility of its kind in North America. The 250,000 sq-ft facility can be readily enlarged. Machinery, much of it automatic, has been set up in units which can be re-located and modified to handle additional production. There is no automation in the accepted sense of the word; instead, flexibility is the keynote of operation.

About 500 workers are employed currently and facilities are geared initially to produce 32 Ramblers a day. On a one-shift basis, the plant is set up to turn out about 10,000 cars a year; two-shift operations at an increased rate could boost this figure to more than 25,000.

Pirating in Little Rock Meets a Challenge

Employers in the Pulaski County, Ark, metropolitan area, faced with a serious shortage of qualified workers in their territory, and tired of the spreading practice of stealing skilled workers in the metalworking industries, are doing something about it. They've established a night school which will furnish classroom instruction in tool and die making, maintenance and mechanics. Classes are being held at Little Rock Technical High School and North Little Rock Senior High School and about 30 students are attending classes at each.

In addition to the employers, the State Employment Security Division, the public schools, and the federal Bureau of Apprenticeship and Training are cooperating in the project. It's felt that a corps of trained men, plus the means for training new workers, will solve the pirating problem and may attract new industries to the area.

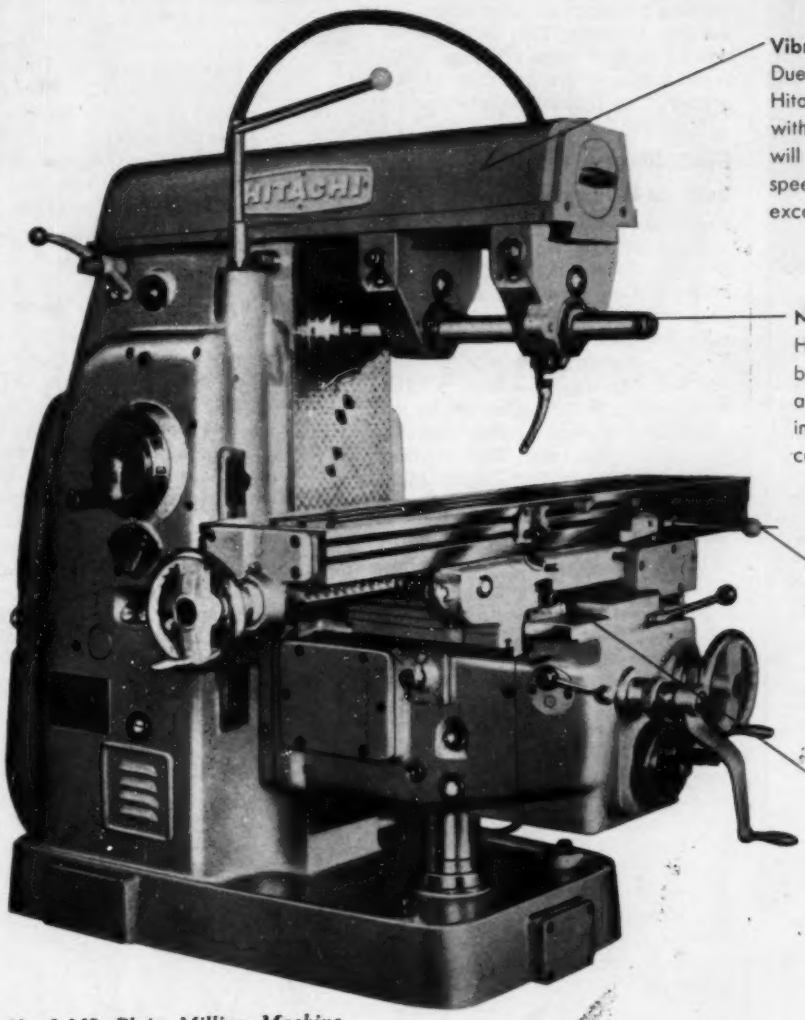
Fafnir Seminars Aimed at Cutting Machine Breakdowns

Fafnir Bearing Co of New Britain, Conn, has established a new training program for maintenance engineers that is designed to help in reduction in breakdowns of manufacturing equipment resulting from ball bearing failure. Program consists of a series of seminars held in various cities throughout the country which are attended by representatives of firms using Fafnir ball bearings; in-

"Production! Production! Production!—That's all you hear these days."

HITACHI

NO. 2 ML MILLING MACHINES



No. 2 ML Plain Milling Machine

Vibration Damping Device
Due to a vibration damping device of Hitachi's exclusive design contained within the over-arm, minimum vibration will be set up even during higher speeds and feeds operation, so that an excellent finished surface is obtained.

New-Type Arbor Support Bearing
Hitachi's unique super precision-type bearing, a combination of plain metal and needle bearing, is incorporated into the machine to enable high speed cutting with high precision results.

Mono-Lever Control System
Hitachi's unique Mono-lever Control System makes the operation simple and easy. Table-feeding too can be performed with ease.

Backlash Eliminator of Lead Screw
As the use of two independent nuts eliminates backlash on the table feed screw, smooth down-cutting can be effected.

SPECIFICATIONS :

- 53 1/8"×10 1/16" Table
- 28" Longitudinal Traverse
- 16 Table Feeds 1/16" — 78 3/4"/min.
- 16 Spindle Speeds 25 — 1,500 r.p.m.
- 7.5 h.p. Main Motor

Hitachi, Ltd.
Tokyo Japan

Cable Address : "HITACHY" TOKYO

New $300 precision cut-off saw paid for itself during 15 minute production run

Navkut*, the new precision cut-off saw, cut production costs substantially at Unicorn Engineering Inc. (now owned by Computer Measurements Company, Sylmar, California). $8 was once the cost of "spacers"—high precision parts which were originally cut from bar stock in a lathe, then milled and ground to a tolerance of .002". After buying the Navkut saw, the production of spacers was reduced to a simple cut-off operation, and costs were cut to 80c a spacer. During every 15-minute production run, the Navkut saw paid for itself. Today, over two years later, the same Navkut is still being used to great advantage in a wide variety of production work.

An operator can cut parallel tolerances to within .002" with the Navkut cut-off saw. And in most cases, the cut finish and accuracy are so precise there is no need for milling or grinding. The Navkut saw will cut ferrous, non-ferrous, wood, and plastic materials with only two types of blades. It sets up in just 1½ minutes. And yet, with all this precision, the Navkut saw costs only $300.

This is the ideal production cut-off for small shops; the ideal auxiliary cut-off for all shops. See for yourself how the Navkut saw can save you money. Write today for a free 15-minute demonstration in your shop.

*TRADEMARK

Navkut saw is another product marketed by:

NAVAN

NAVAN PRODUCTS INC.

Subsidiary of
North American Aviation, Inc.
900/H North Sepulveda
El Segundo, California

vitations are extended by Fafnir distributors.

Meetings are conducted by a company instructor in conjunction with a traveling school for distributors' salesmen which has been carried on for a number of years. A variety of instruction materials are provided including a 24-page manual on ball bearing failures. The seminars are devoid of any sales pressure; problems discussed are common to products of all bearing manufacturers.

Bell's Niagara Plant Back in Helicopter Work

Helicopter production has started again after a nine-year lapse at the Niagara Falls plant of Bell Aerosystems Co. Company has begun subassembly work under a contract with Bell Helicopter Co of Ft Worth, Texas; both companies are divisions of Bell Aerospace Corp, a Textron company. Helicopter production ceased at the plant in 1952 when the company, then the Bell Aircraft Corp, opened its Fort Worth plant.

Harman-Kardon, Jerrold Combine

Harman-Kardon Inc, Plainview, Long Island, manufacturer of high fidelity components and logic modules for data systems, has been acquired by Jerrold Electronics Corp and will be operated as a separate subsidiary by the Philadelphia firm which produces electronic amplification equipment for closed circuit television distribution systems, electronic test instruments, and electronic consumer products.

Integration of the two companies creates a diversified electronics organization specializing in a range of electronic products and communications systems for consumer, industrial, commercial, and military markets.

Ford Has Order for 5800 Trucks

A government vehicle contract totalling $7.3 million for 5800 pickup trucks has been awarded to Ford Division of Ford Motor Co. Seven assembly plants from New Jersey to California will share in carrying out the order. Plants and their allotments are: Norfolk, Va, 2280; Milpitas, Calif, 1319; Mahwah, NJ, 937; Dallas, Tex, 495; Chicago, 287; Kansas City, Mo, 276; and St Paul, Minn, 206.

This brings to three the number of multi-million-dollar vehicle contracts that the government has placed with Ford within two weeks; other two were for buses and station wagons. Combined orders add up to over $12.5 million.

Harvill Building Big Facility

Construction of a $1.3 million manufacturing plant has been started by Harvill Corp, Los Angeles maker of die-cast products of metal, and molded plastic products. The 101,000 sq-ft facility on a 7½-acre site near Compton, Calif, will employ many new processes and materials, according to the company, and will increase production capacity by more than a third. It's scheduled for July occupancy and will employ approximately 250.

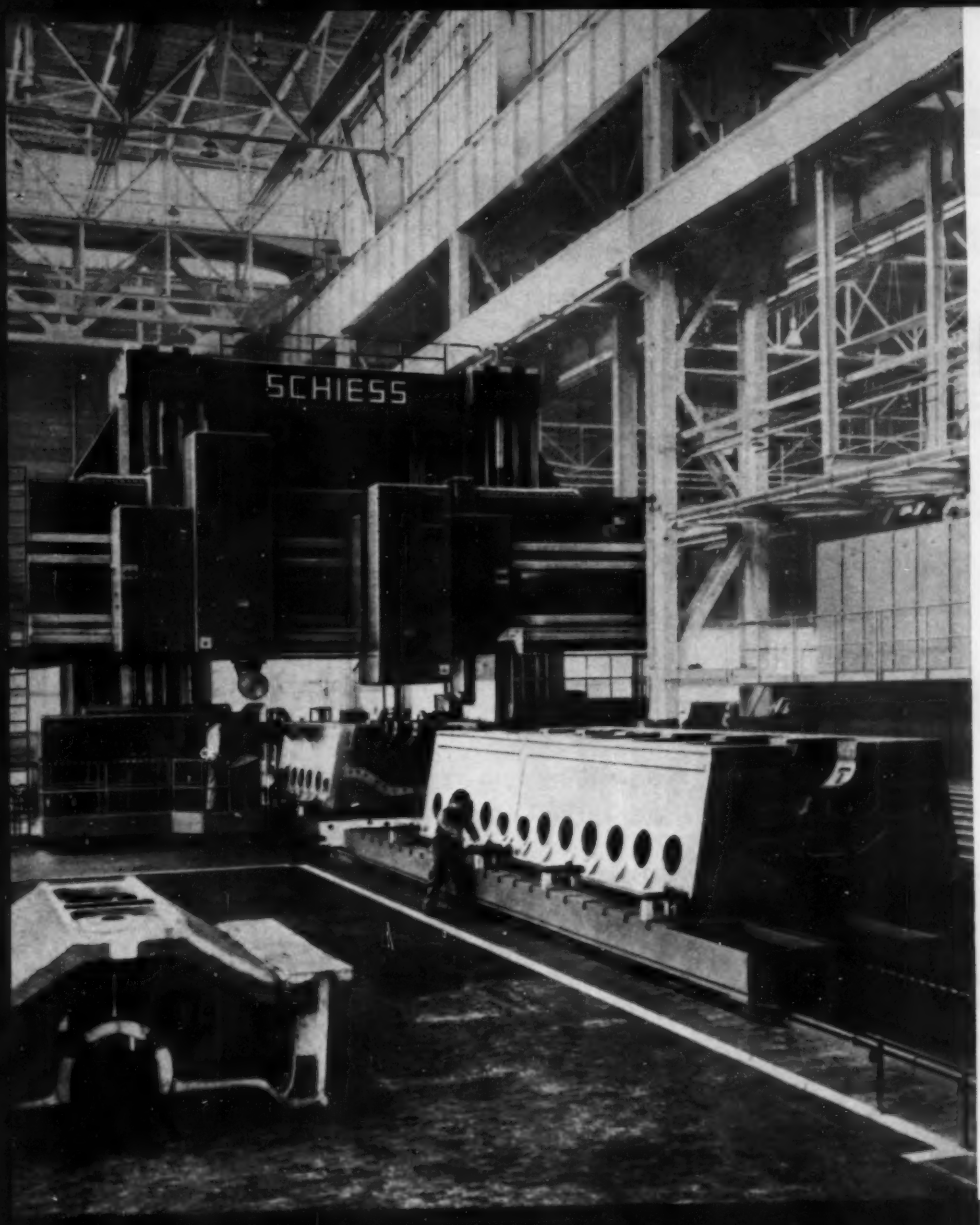
Chromalloy Takes Over Shunk

Chromalloy Corp, headquartered in New York, has acquired the Shunk Manufacturing Co of Bucyrus, Ohio, the country's oldest and largest producer of replaceable blades and cutting edges for earth-moving, road construction and maintenance, and snowplow equipment. It'll be operated as a wholly owned subsidiary of Chromalloy which produces high-temp metal coatings, Sintercast and nuclear metals and alloys. Chromalloy metallurgists and Shunk engineers will collaborate in production of improved metal products.

Shunk has modern facilities for both hot and cold forming; Chrom-

(continued on p 246)

"Since the safety engineer hung up that sign, no one has been able to get it into operation."



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If you sell to metalworking, ask your customers to tell you which business publications they find most useful in their work—then advertise there. Twenty-five companies conducted such surveys on their own during the last 10 years—and American Machinist/Metalworking Manufacturing was consistently the winner . . . hands down!

Reason? AM/MM is the technical publication of metalworking—and metalworking is a highly technical industry.

AM/MM concentrates on how-to articles, case histories and *working* information on the often highly complex methods and procedures involved in manufacturing things from metal more efficiently, more profitably. In short, it's a 26-times-a-year work book. If metalworking is your market, it will work for you.

For up-to-date facts and figures on metalworking, ask your AM/MM *district manager for a copy of the 1960 Market Guide for Sales Executives.*

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Our inspection projector magnifies cutting edges to eliminate the minute angular deflection that could cause you costly production losses . . . just one of many inspections that account for Circle R quality.

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Developments in interferometry are playing an ever-growing role in the search for better and more efficient inspection equipment in metalworking. There's a host of valuable data in our 16-page special report that's available for 35¢ from

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American Machinist/Metalworking Manufacturing
330 West 42nd Street, New York 36, N. Y.

alloy's nearby foundry division at Elyria, Ohio, has been turning out high quality gray iron castings for more than half a century and will work closely with Shunk in product areas involving heavy steel fabrication, opening a new field for the Elyria division.

DoAll Opens Sales-Service Store In West Germany

DoAll Co, Des Plaines, Ill, has opened its first overseas sales-service store in Dusseldorf, to provide European industry with a broad line of its American-made manufacturing tools. This is the initial move in a foreign expansion program by the firm to establish sales-service facilities in England, Australia, India, and Japan. The subsidiary will sell machine tools, bandsaw blades, granite surface plates, gage blocks, perishable tools, and will offer a complete saw band welding service.

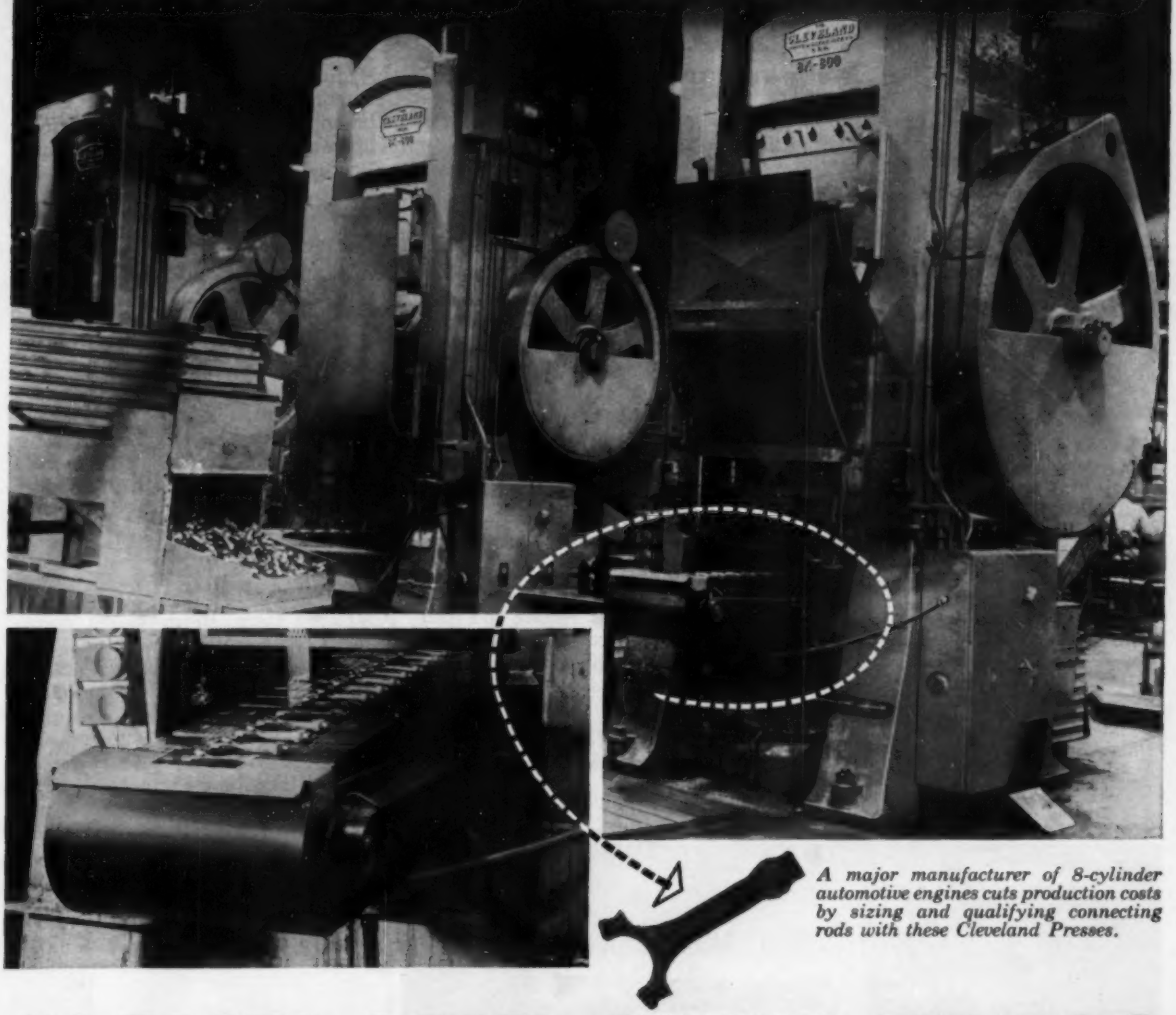
The store will be equipped with auto-drawn trailers to take machine tools direct to European factories to sell by demonstration. One sales tool is an 8mm sound projector for showing in customers' plants color motion pictures that point up the design, construction, and operating features and performance of company's tools and measuring equipment.

Machinery Builders Acquired By Arcs Industries

Arcs Industries Inc, an engineering and manufacturing organization headquartered in Bellmore, Long Island, is taking over Machinery Builders Inc, a producer of compo-

"Ah ha! Just as I thought! Faulty switch"

CHIPLESS MACHINING



A major manufacturer of 8-cylinder automotive engines cuts production costs by sizing and qualifying connecting rods with these Cleveland Presses.

CLEVELAND KNUCKLE JOINT PRESS

Fully automated with chain-type conveyor feed, these three 800-ton Cleveland Knuckle-Joint Presses eliminate expensive machining operations. Cleveland's massive, carefully fitted knuckles exert a "super" squeeze on the cold metal that straightens the part, sizes it to close tolerance of the order of .0005".

This "chipless machining" is cutting costs in forge shops and automotive engine manufacturers due to the greater accuracy possible with Cleveland Presses. Cleveland's long slide bearing surfaces and rugged frame construction hold deflection to a minimum under maximum load.

With capacities from 150 to 3000 tons and bed areas from 18 x 18" to 50 x 54", Cleveland Knuckle Joint Presses do the job efficiently, economically. Investigate the COST-CUTTING advantages of these Cleveland Prerses by writing today for Catalog K2. A-4001A

OTHER COST-CUTTING CLEVELAND PRESSES

INCLINABLE • STRAIGHT SIDED CRANK • STRAIGHT SIDED ECCENTRIC • 4-POINT UNDERDRIVE • DOUBLE ACTION TOGGLE

THE CLEVELAND PUNCH & SHEAR WORKS CO.
Established 1880

Power Presses
Fabricating Tools
Punching Tools & Dies

Division of OHIO FORGE & MACHINE CORP.

E. 40th and St. Clair Avenue, Cleveland 14, Ohio

MADISON SPADE DRILLS REDUCE TOOL COSTS 60%-80% OVER TWIST DRILLS

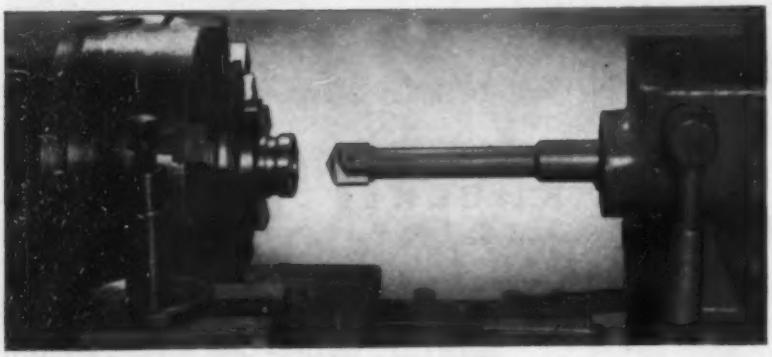
It's a fact! And here's the proof to back up our statement.

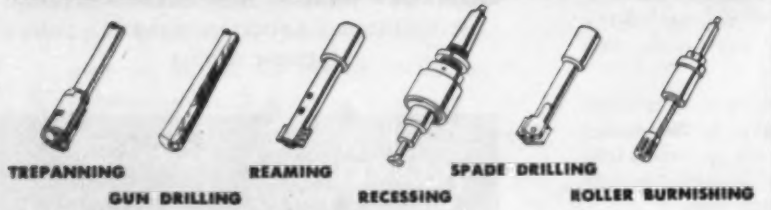
With Madison spade drills, the work is done in one pass from the solid — no need for progressive drilling. Damage to the tool is sharply reduced due to the forced flow of coolant through the Madison tool holder and the rapid elimination of the small C-shaped chips from the work. There's no stopping to remove chips.

You save money because of reduced tool inventories required. One Madison tool holder accommodates a wide range of bit sizes, and spade drills cost much less than twist drills.

Downtime is negligible. There is no need to remove tool, grind, replace and reset for depth as is necessary with twist drills. You merely change cutters at the machine — often while it is functioning on other operations.

Ask your local Madison Man to tell you more or write for our latest bulletin.





MADISON *Industries, Inc.*

P. O. BOX 1137, PROVIDENCE, RHODE ISLAND

nents for jet aircraft engines, with a manufacturing plant in the Bronx. Company, which will operate as a wholly owned subsidiary, is a supplier to Pratt & Whitney, major producer of jet engines, and to other leading engine manufacturers. Arcs manufacturing division works mostly on a subcontract basis for such firms as IBM, Sperry, Fairchild, and Bendix, and for government agencies as a prime contractor.

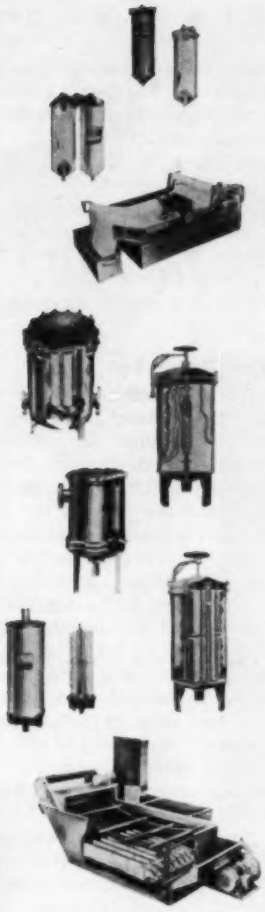
Rocket Engine Order to Thiokol

A $2.1 million contract for production of M60 solid fuel rocket engines for the Falcon missile will be carried out by Thiokol Chemical Corp's Redstone Division at Huntsville, Ala. Hughes Aircraft is the prime contractor for AF's air-to-air weapon. The Division also has a contract for development studies of big solid fuel boosters for NASA's space programs.

Valeron Sets Up Overseas Affiliate

Valeron Corp, Detroit-based manufacturer of metal cutting tools and carbides has organized an affiliate to sell and service its products abroad. New organization, to be known as Valeron S A, has established headquarters in Frieborg, Switzerland. An engineering office, staffed with American-trained personnel, will be maintained overseas to supply design and consulting services to foreign metalworking manufacturers. Valeron S A representatives will be located in all of the

"You the people who wrote inquiring about our inventory control system?"



4311

CFC MODELS AND MEDIA TO MEET YOUR FILTRATION NEEDS

The standard line of CFC filtration equipment includes over 4311 different models and media. And if one of these isn't ideal for your application, CFC will engineer a filter to your exact needs.

CFC filters all types of industrial fluids — from Air to Zinc Cyanide — from 1 gallon per hour to 2700 gallons per minute. The complete line includes **FULFLO** Filters with media made from a wide variety of natural or synthetic fibres, resin-impregnated paper, sintered or woven metals and porous ceramics for precise filtration of liquids and gases; **HONAN-CRANE** Filters with fibre, resin-impregnated paper or adsorptive earth media for industrial oils; **DELPARK** Continuous Filters for cutting oils, coolants and other industrial liquids.

Look to CFC Filters — to improve product quality, cut maintenance and production costs, protect valuable equipment and reduce costly down time. Write for catalog or engineering assistance to Dep't AM

CFC

COMMERCIAL FILTERS CORPORATION

Fulflo Honan-Crane Delpark Michiana

MELROSE 76, MASSACHUSETTS

PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

Improved Versatility For Tool And Model Rooms

LINLEY
JIG BORERS

For efficient handling of precision tool and die work

The Linley Jig Borer is accurate to a high degree. It is fast to set up and position and has the versatility required for precision tool room and die work, yet is low in cost.

Many time-saving accessories are now available for use with the improved Linley that add to its usefulness and simplify its operation.

Check on the many advantages of this improved jig borer. Table size is 7"x17½"; table travel, 6½"x10".

Send for descriptive literature.

LINLEY BROTHERS CO.
664 State Street Ext.
Bridgeport 1, Conn.

important manufacturing countries throughout the European continent including Scandinavia and the British Commonwealth.

Future plans for the new affiliate include establishment of complete manufacturing facilities on the continent for production of carbides and many of the high-production metal cutting tools developed in this country by the parent company.

Lockheed Needs You

Lockheed Aircraft Service, a subsidiary of Lockheed Aircraft, has received more than $2 million in new orders for its Special Devices Division at Ontario International Airport since the first of the year, requiring an immediate and substantial increase in its engineering staff.

Among the projects currently underway or soon to be started are engineering and development of advance recording systems, jet aircraft training systems, corrosion prevention systems, ground transportation systems, and support programs for missile and satellite projects. Requirements include electronics, electrical, and mechanical engineers, draftsmen, and technical writers. LAS now employs approximately 1500 at Ontario in its aircraft maintenance and modification base and its Special Devices Division.

Philadelphia Gear Adds Test Unit

Construction of a new gear research building and pattern shop has been started by Philadelphia Gear Corp on a 30-acre tract at King of Prussia Pa. These additional facilities, to be located next to the recently completed manufacturing plant and general offices, will allow the company to perform isolated testing of gear trains for radar and radio telescope applications entirely removed from vibrations.

Metals Dept Established by Dow

Dow Chemical Co has formed a new Metals Department that'll pull together and be responsible for various Dow activities in magnesium and other primary metals. This will include the development of primary magnesium for die casting, chemical uses of magnesium, and other metals. The new department will be separate and distinct from the Dow Metal Products Co Division which remains responsible for processing and fabrication of aluminum, magnesium, and other mill products.

NH Ball Bearings Expanding

A 101-acre site in the new O'Shea Industrial Park being developed in Laconia, NH, has been acquired by New Hampshire Ball Bearings Inc. Construction of an 18,000 sq-ft plant will start about May 1. Facility, the seventh major expansion in the Peterborough company's 15-year history, will provide additional capacity to produce instrument ball bearings and is designed to provide for later expansion to 75,000 sq ft. Plans call for employment of 90 people within two years and eventual employment for several hundred.

Arnhold Ceramics Forms Subsidiary

A new subsidiary company, AC Compacting Presses Inc, has been established by Arnhold Ceramics of New York. The new firm will take over the functions formerly carried out by Arnhold's Dorst Division and will be the US and Canadian sales and engineering organization for Dorst precision compacting and coining presses which are used to press parts from metal and ceramic powders.

Studebaker Acquires Additive Firm

Chemical Compounds Inc, St Joseph, Mo, processor and distributor of additives for motor oil and fuel, has been acquired by Studebaker-Packard Corp, South Bend, Ind. Company, the sixth acquisition under S-P's diversification program, will be operated as a division.

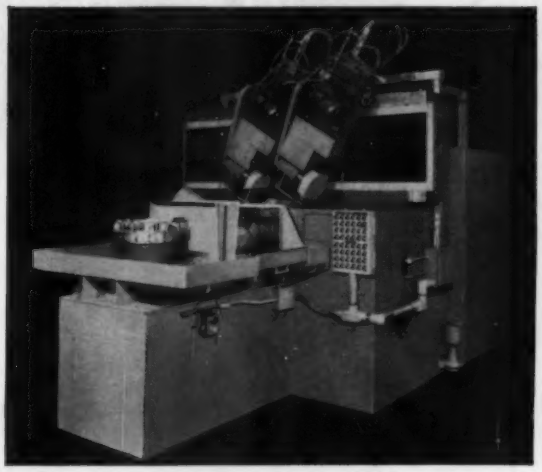
Navy's First Hydrofoil Under Way

Construction of the Navy's first operations hydrofoil patrol boat has been started at Tacoma, Wash, with the laying of the keel for a 115-ft,

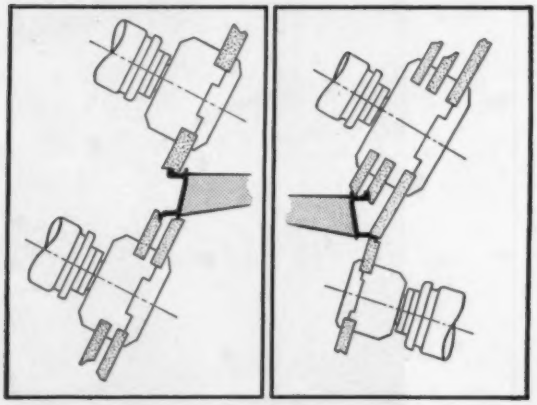
"An' what's left is called take-home pay—an' it's about the only place you can afford to take it, too!"

Vertical grinding 19 surfaces efficiently

Turbine blades for jet engines require such precise accuracy and smooth finish on so many surfaces that the only economical way to grind them in large quantities is *vertically*. In vertical grinding, whether on standard machines or complex specials, gravity works directly for you. The machine does not have to overcome gravity—the result is simplified fixturing and efficient, highly accurate indexing. Single or multiple grinding heads advance to difficult surfaces, grind, then retract for automatic dressing and size control as a new piece is indexed.



Vertical production grinder shown above is typical of Springfield four-head machines in jet engine plants. An upper and lower head are located at each station. Station operations are shown below.



Left station — 7 surfaces ground in one pass.

Right station — 12 surfaces ground in one pass.

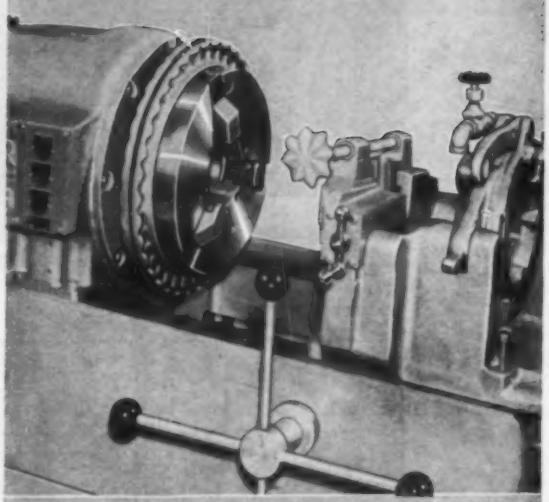
When high production and accuracy dictate your grinding requirements, it will pay you to investigate the Springfield principle of vertical grinding. The pay-off is also in floor space savings and in the fact that heads usually can be repositioned when part requirements change.

If you would like to know more about the vertical grinding principle, please send for our Bulletin 197-C. The Springfield Machine Tool Company, Springfield, O.

SPRINGFIELD

THREADS 1 TO 4-INCH
PIPE WITH...
NO DIE CHANGE!

BEAVER
SPEED KING



Only BEAVER

Only 980 lbs.!

BEAVER — Send for complete catalog and name of nearest distributor

PIPE TOOLS, INC.

DANA AVE.
WARREN, OHIO

110-ton aluminum craft. Designed for antisubmarine and patrol work (its top speed is 50 knots), it is being built by Boeing Aircraft at the Martimac Shipbuilding Corp yard and is scheduled for completion late next year.

Stokes Sets Up British Subsidiary

Incorporation of F J Stokes Ltd, with headquarters in London, has been announced by Francis Dougherty Jr, president of the 65-year-old American firm which manufactures automatic plastics molding equipment and other high-speed automatic machinery for production of powder metal parts and other products for the chemical, automotive, electronics, and food industries. The new British subsidiary will market several of Stokes' range of machines and equipment for these industries and will make them available throughout the British Isles, the Commonwealth, and countries of the European Free Trade Association.

British manufacture of Stokes equipment is already under way in association with Thomas White & Sons Ltd of Paisley, Scotland, a builder of industrial machinery founded in 1863. Stokes plastics molding equipment made in the UK will incorporate all of the refinements developed during the company's 25 years of experience with completely automatic molding.

Manhattan Rubber Division . . .

. . . of Raybestos-Manhattan, Passaic, NJ, has acquired the abrasive and grinding wheel business of US Rubber Co. In addition to its own line, Manhattan will now turn out grinding wheels made with the same rubber and resin bond formulas and equipment as those formerly made by US Rubber. •

"Gentlemen, you have lowered the rejection rate to 2% and in view of this superb performance, this department is now overstaffed . . ."

Recent help-wanted advertisement appearing in Minneapolis Morning Tribune.

Why this plant can afford top pay and overtime on its Moore Jig Grinder

This versatile precision machine has been a *night-and-day* moneymaker throughout the twenty-odd years since Moore pioneered the principle of Jig Grinding. Ask any Moore owner! Ask Carl A. Berg, for example, who ran the above advertisement for his new No. 3 Moore Jig Grinder in a Minneapolis newspaper recently.

That's because Jig Grinding is the happy answer to the ever-present problem of accurately locating and grinding holes, contours and surfaces to size in hardened steel and carbides. The No. 3 now holds tolerances to *less than a tenth!* See positioning accuracies under photo of the machine at right.

Mating parts such as punches and dies can be finished concurrently and made to figures by Jig Grinding with the Moore, rather than just "to fit." Service life is greatly increased, because fits are more accurate, alignment is assured and surface finish is improved.

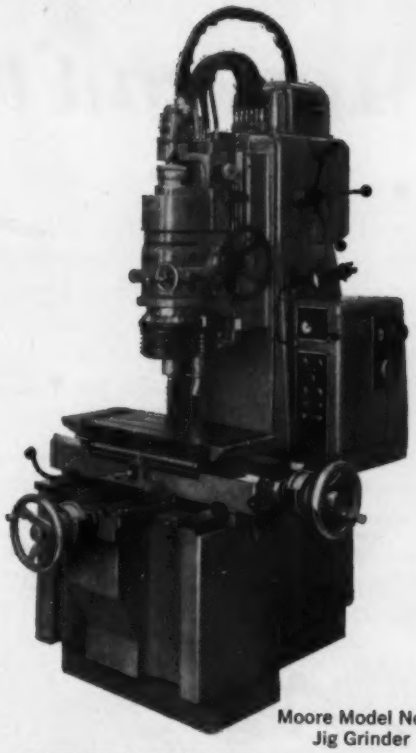
The flexibility and accuracy that make it a "must" for toolroom applications also make the No. 3 Jig Grinder a key machine in model, experimental, precision machining, and development work. Here, prototype and critical parts are quickly produced to the closest tolerances required.

When users offer top pay and overtime to operators of this busy machine, *they do so because it earns that kind of return* ...for toolroom, production, experimental laboratory and inspection assignments.

May we prove it to you?

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Conn.

HOLES, CONTOURS AND SURFACES, Moore's authoritative book of 424 pages, 495 illustrations on tool, die and precision parts production, includes these fine chapters: "Jig Grinding Principles and Applications," "Jig Grinding Holes," and "Jig Grinding Contours." $5 in U.S.A., $6 elsewhere.



Moore Model No. 3 Jig Grinder

ACCURACY OF POSITIONING

LONGITUDINAL TRAVEL:
Greatest error in any inch ..... 30 millionths
Greatest error in 18 inches ..... 90 millionths

CROSS TRAVEL:
Greatest error in any inch ..... 30 millionths
Greatest error in 11 inches ..... 90 millionths

SQUARENESS:
Compound slide ..... 60 millionths
Travel, spindle housing ..... 90 millionths in 13"
Travel, spindle ..... 90 millionths in 3⅛"

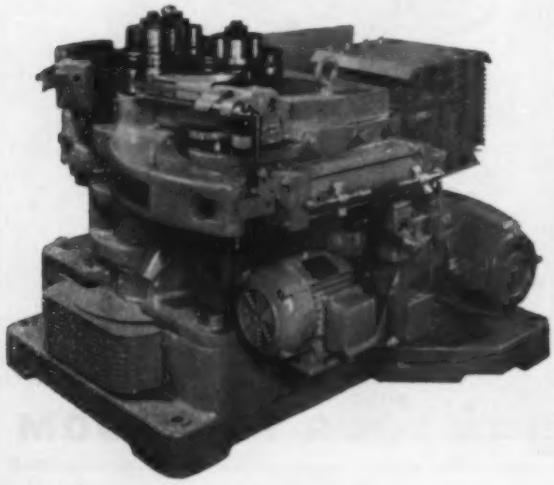
ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

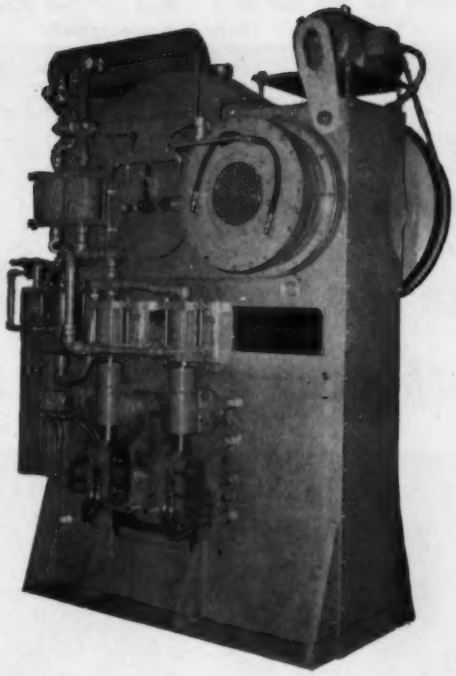
ARE YOU TRYING TO BE COMPETITIVE WITH OBSOLETE EQUIPMENT? Don't get caught in the "profit squeeze" caused by rising production costs. Check into these fast, efficient 'Buffalo' machine tools. Your nearby 'Buffalo' machine tool dealer will be glad to show you how the *right* 'Buffalo' equipment will boost your production and profits. Bulletins are available upon request.

You can't compete when

HIGH-SPEED DIE-LESS COLD METAL BENDING—For fast, commercially accurate bending of tees, angles, beams, flats, pipe and tubing into arcs, segments and spirals — 'Buffalo' Bending Rolls can't be beat. Standard or special rolls are available for any structural shape. One pass completes the job without heat or dies. Horizontal, vertical, pinch type and aircraft models are available in a variety of sizes and capacities. Quality built for a long life of trouble-free operation. For more profitable bending, contact your nearby 'Buffalo' machine tool dealer.

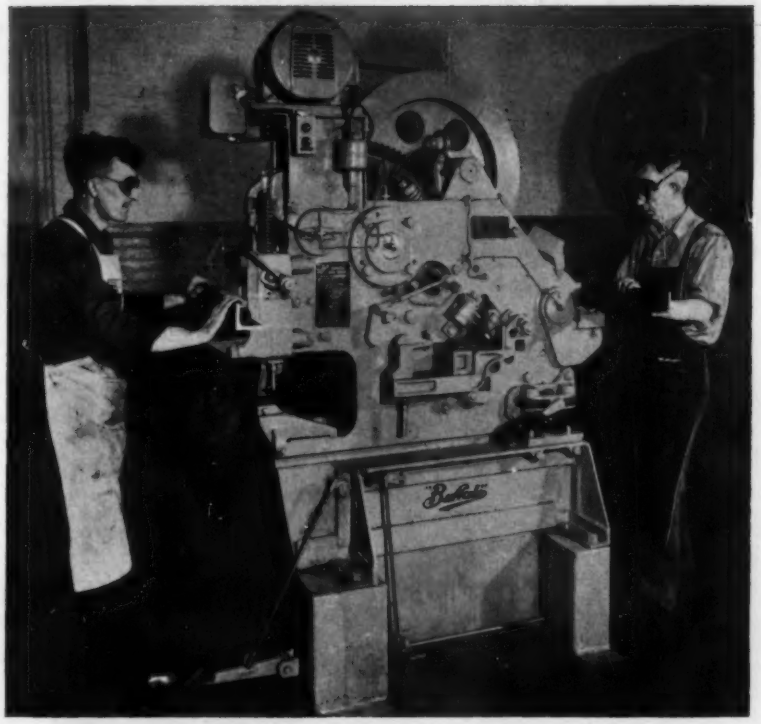


INCOMPARABLE DRILLING EASE, SPEED AND ACCURACY — Beat rising production costs with the rugged 'Buffalo' RPMster. This precision drill gives you instant finger-tip spindle speed control from 90 to 10,000 RPM. Choose from capacities up to 2". Optional hollow spindle (shown) permits use of special new bits for drilling super-hard metals and ceramics. All-geared power feed insures effortless precision. The RPMster is quick and easy to set up . . . table-raising screws and ground, polished ways see to this. Will provide years of trouble-free service.



FAST, CLEAN BILLET SHEARING — With new, high-speed 'Buffalo' Billet Shears you enjoy lower cost per cut. For example, the Number 400 (shown) can give you up to 18,000 cuts per 8-hour shift. And you get clean, square-cut billets. While the 400 cuts any shearable material up to 4½" rounds or 4" squares, other models handle up to 10" rounds. Control is electrical. Frame is rigid alloy steel plate. Lubrication is automatic. Top quality throughout insures long, trouble-free life.

you're obsolete



7 OPERATIONS ON *ONE* FAST MACHINE WITHOUT CHANGING TOOLS — Called "the most useful machine in the shop", the 'Buffalo' Universal Iron Worker helps you slash fabrication costs. In the floor space of only one machine, it cuts, punches, shears, slits, copes, notches, miters. It does two jobs at once . . . quickly handling your angles, tees, beams, channels and bars. The U.I.W. is an all 'round machine — ideal for production or maintenance jobs. See how the 'Buffalo' Universal Iron Worker can save money in your shop. Have your 'Buffalo' dealer arrange a demonstration.

"Buffalo"

MACHINE TOOL DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

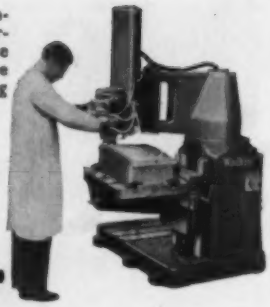
'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

The medium capacity machine, type L.C.6 with power-operated rise and fall to the head, integral base plate and rising and falling tilting table.



Milling ALUMINUM *up to ten times faster than by any other means!*

Wadkin Heavy Duty Articulated Arm Router, L.C. face-milling gearbox end covers.

For rapid, precision milling of aluminum components Wadkin Articulated Arm Routers are way ahead. Not only do they boost output and cut production costs, but their price is relatively low as compared with conventional millers. Wadkin machines employ new high speed milling techniques. With cutting speeds up to 18,000 r.p.m., low tooth loading of the cutter, and only light clamping of the component, face-milling is done in a fraction of the time normally taken. On pocketing operations, too, an easily obtained metal removal rate of 20 cubic inches per minute cuts production times down to an absolute minimum.

Three models are available: type L.C. with either 6′ 0″ or 8′ 0″ reach and a smaller type L.C.6.

Write today for Catalog 945 from your nearest Wadkin Agent, listed below.

This component was machined from the solid on a Wadkin L.C. Router with a saving of many hundreds of hours over conventional milling methods.

Wadkin

HIGH SPEED MACHINE TOOLS

Supreme Machine Tool Corp., 130-40 180th Street, Springfield Gardens, Jamaica 3′, N.Y.
Machinery Sales Co., 2838 Leonis Blvd., P.O. Box 58362, Los Angeles (Vernon) 58, CAL.
Wigglesworth Machinery Co., 60 Border St., P.O. Box 166, East Boston 28, MASS.
Machinery Associates, 500 Piedmont Avenue, Atlanta 8, N.E., GEORGIA.
Childs Machinery Inc., P.O. Box 700, Atlanta 1, GEORGIA.
Machine Tool Sales Company, 1809 Canton St., Dallas 1, TEXAS.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 CYLINDRICAL GRINDERS—*Landis Tool Co, Waynesboro, Pa.* 8-page catalog CG-60 illustrates and describes features of universal, plain, and roll grinders; the new Landis 12R centerless grinder; and a line of single-purpose grinders. Specifications provided.

2 TURRET LATHE—*Rivett Lathe & Grinder Inc, Brighton 35, Boston, Mass.* 6-page bulletin 60T presents illustrated information on the 60 Series features of which include new bed form that features double-bevel and dovetail; distortion-free mounting; automatic indexing turret; one motion control; double tool cross-slide.

3 ELECTROLYTIC DRILL SHARPENER—*Connecticut Special Machine Inc, Bridge St, Winsted, Conn.* 4-page folder on the new Ampak HSS drill sharpener covers the subject of electrolytic drill sharpening with the unit, describes the machine, its features, and capabilities. The Ampak makes possible relative combinations of point angle, lip relief angle, and helix angle to solve all vital cutting needs. Range of geometric angles gives every possible drill point that is practical for drilling metal, fiber, plastics, wood, and allied materials. Chief advantage of the process is a sharpening rate 3 to 7 times faster than conventional methods without generating the heat that may alter the metal's structure.

4 COMPRESSION BENDING MACHINES—*Pedrick Tool & Machine Co, 3638 N Lawrence St, Philadelphia, Pa.* 8-page bulletin 60 on line of production units discusses the various types of bending and the economics of the process. Various models of Pedrick benders are shown with specifications and application recommendations for each. Includes charts on section moduli of pipes, tube, and bar as well as tensile strengths.

5 DRILL GRINDER—*Farrel-Birmingham Co, Consolidated Machine Tool Division, 565 Blossom Rd, Rochester 10, NY.* 4-page bulletin 4000-A describes features and operations of the 4G Model. This self-contained dry grinder has a maximum capacity for 2 and 4 lip drills up to 3 in. dia and for 3 lip drills up to 2-9/16 in. dia

"Will you be interested in learning the trade or just the tricks?"

EECO PACKAGED CIRCUIT MODULES

for digital systems engineering

STANDARD-SERIES Plug-in Circuits

T-SERIES Germanium Plug-in Circuit Modules

T-SERIES BREADBOARD EQUIPMENT

MINISIG® Sensitive Indicators

N-SERIES Transistorized DECADES

CORE-DIODE/CORE-TRANSISTOR MODULES

DIODE/MATRIX Plug-in Circuit Modules

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W-SERIES Silicon Plug-in Circuit Modules

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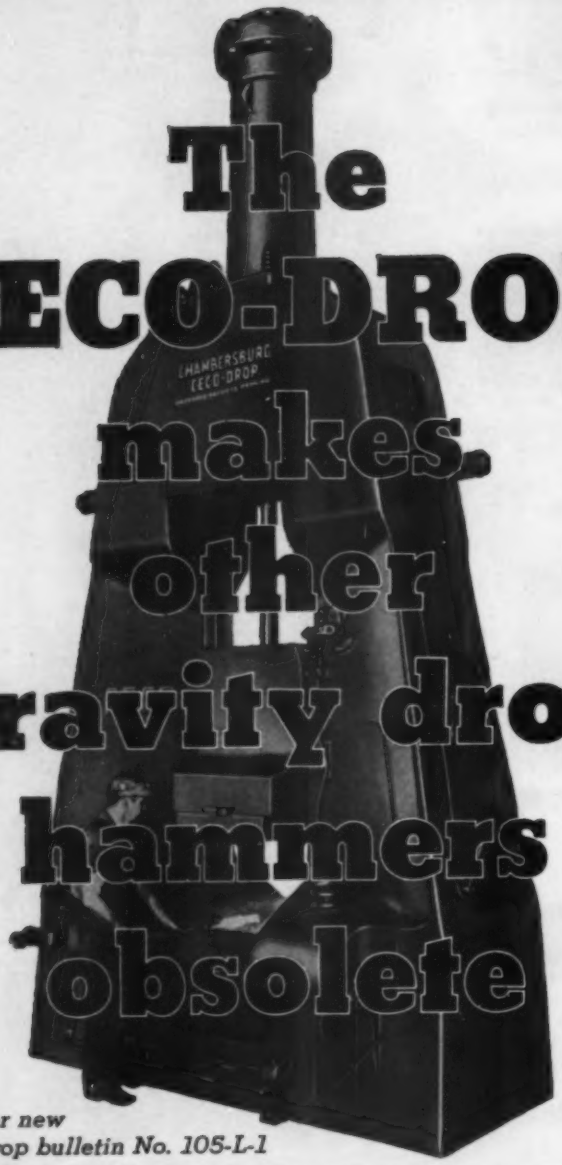
With these NEW features:

1. CECO BLOWMATIC PROGRAM CONTROLLER: for semi-automatic forging
2. NEW RAM INCHING DEVICE: makes die-setting easier and safer
3. FASTER ACTING ROD CLAMP: by means of double-acting clamp cylinder
4. NYLON-TIPPED KNOCK-OFF DOG: reduces shock, reduces wear

NOW – more than ever...

The CECO-DROP makes other gravity drop hammers obsolete



Write for new Ceco-Drop bulletin No. 105-L-1

CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG, PA.

CHAMBERSBURG

• The Hammer Builders •

DESIGNERS AND MANUFACTURERS OF THE IMPACTER

When it's a vital part, design it to be FORGED

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

6 MICROSTONING MACHINES — *Taft-Peirce Manufacturing Co, 32 Mechanic Ave, Woonsocket, RI.* 7-page supplement to catalog 319 provides information on the No. 80 and No. 81 Microstoner; accessory equipment for Microstoners; Microstones; the No. 86 plunge cut centerless machine; and the No. 88 through-feed centerless machine.

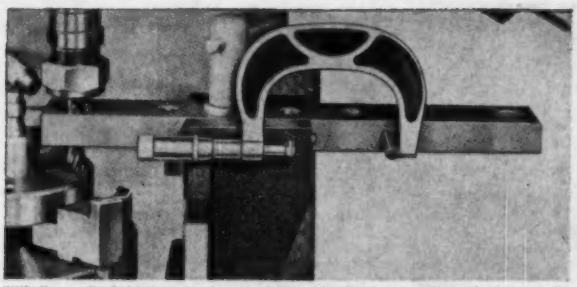
7 HORIZONTAL GEAR SHAVERS— *National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich.* 16-page bulletin S-54-2 pictures and describes line of Red Ring machines for the horizontal shaving of large external gears. Design features pictured and discussed; specifications and capacities given in tabular form.

8 GEAR DEBURRING AND CHAMFERING GRINDERS—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* Two 1-page bulletins contain information on features and operation of grinders for spur and helical gears (Model 482A) and for bevel gears (Model 452). The former is available in three sizes for gears from 1 to 24 in. OD; the latter in three sizes for gears from 1 to 36 in. OD. Because twin grinding wheels are used, the entire contour of both ends of the gear teeth are ground in the 20 to 40-sec automatic cycle. Adjustable counterweights on each spindle permit correct setting of grinding pressure for each type of operation.

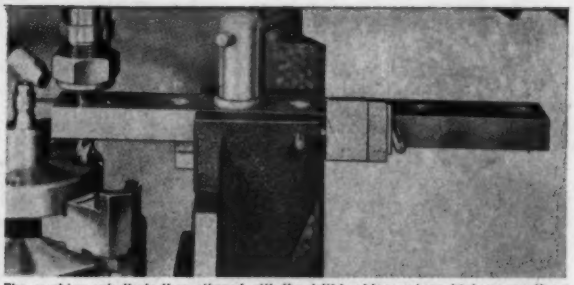
9 MACHINING LAMINATED PLASTICS — *National Vulcanized Fibre Co, 1061 Beech St, Wilmington 99, Del.* Reprint of a technical article, "Machining Laminates," describes the specific fabrication methods for standard laminates and for recently introduced grades. Methods described are: sawing, punching, drilling, tapping, planing and shaping, gear cutting, lathe and screw machining, milling, finishing, marking, reaming, and shearing. Tooling requirements and recommended setup procedures are discussed. Photos illustrate important machining operations.

10 PRESS CLUTCH—*Dechert Dynamics Corp, 713 W Main St, Palmyra, Pa.* Illustrated brochure describes features of air-clutch mechanism available on Zeh & Hahnemann and Robinson industrial presses. Discusses advantages including increased production and reduced maintenance.

"One of the worst sandwiches I ever tasted."



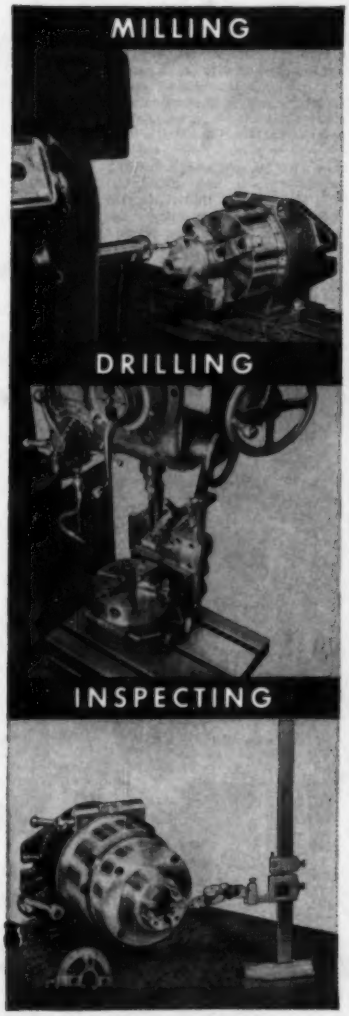
With the vertical drilling attachment, drilling can be done on the end of the workpiece. After aligning the ERICKSON master spacer with the machine spindle, the sliding bar on the attachment is located to the desired accuracy and locked. A direct over-pins micrometer reading gives the distance from master-spacer centerline to center of a drill bushing on the sliding bar.



The machine spindle is then aligned with the drill bushing and machining operations are performed. In the photograph, the drill bushing has been removed for a counterboring operation. Jo blocks were used for extreme accuracy in this setup. A horizontal drilling attachment is available for locating holes (with the same accuracy) on the side of the workpiece.

Micrometer or Jo-block adjustment of drilling attachments bypasses fixture cost and lead time

Get into production fast...with an ERICKSON MASTER SPACER



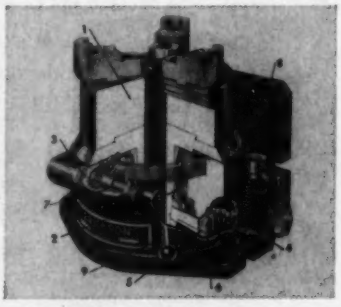
Here is a rotary positioning device as accurate as a jig or fixture, yet rugged enough for straddle milling! With the ERICKSON master spacer, you receive guaranteed radial accuracy of 0.001 in. cumulative error on a 6-in. diameter circle.

In many cases, the ERICKSON master spacer will eliminate the need for expensive jigs and fixtures. It holds highest accuracy under heavy cuts, interrupted cutting, side thrust, or torque loads. Use it when milling, shaping, drilling, boring, or grinding.

The ERICKSON master spacer mounts either horizontally or vertically, so it can be used for machining either the side or the end of the work. For holes on a bolt circle, location is determined by the master spacer and the drilling attachment, and is not dependent upon machine accuracy. The attachment can be set with either a micrometer or with Jo blocks—giving you just the accuracy you need for your job. You can forget drill jigs if you have an ERICKSON master spacer.

Timken-Bearing Spindle Gives Rigidity and Accuracy

THE **ONLY** MASTER SPACER WITH TIMKEN BEARINGS! Three-jaw 6-in. chuck (1) holds work firmly and centers it. Completely sealed Timken bearings (2) assure highest accuracy during indexing. Adjustable zero plate (3)—beveled for easy read-off—locates index points. Hardened index plunger (4) wedge-locks precision hardened and ground 24-position index plate (5)—has zero backlash. Changeable masking plate (6) speeds indexing in production work. Brake shoes (7) are full floating—work can be set up, then **clamped without affecting perfect alignment.** Brake protects index plate and plunger from torque stresses. Index plunger lever (8) and brake lever (9) are spaced for easy one-hand operation.



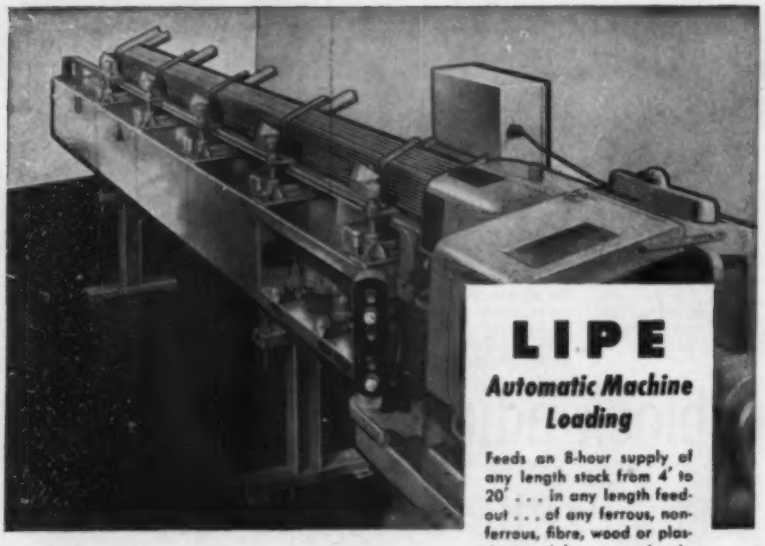
SEND FOR COMPLETE MANUAL

The manual on the ERICKSON master spacer gives the complete story, including construction details, dimensions, and how the vertical and horizontal drilling attachments are set up and used. Six full pages of solid tooling data—yours for the asking.

ERICKSON TOOL COMPANY

34356 SOLON ROAD • SOLON, OHIO

(Greater Cleveland)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Automatic Machine Loading
Feeds an 8-hour supply of any length stock from 4' to 20' . . . in any length feed-out . . . of any ferrous, non-ferrous, fibre, wood or plastic material . . . ranging in diameter from 1/16" to 1 1/2".

Continuous Automatic Feed

of bars, rods, tubing in practically every shape used!

LIPE AML Bar Feeds will give you faster, finer production with less scrap and refinishing and a more efficient use of manpower.

They are applicable to a wide variety of machines, including single-spindle automatic screw machines, turret lathes, centerless grinders, abrasive-wheel cut-offs, punch presses, cold headers, die machines and others.

Sold and serviced by franchised distributors in principal industrial areas. Write or wire for complete information.

STOP CUTTING AIR AND YOU START CUTTING COSTS

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PIONEERS IN PNEUMATIC BAR-FEEDING

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

TOOLS AND ACCESSORIES

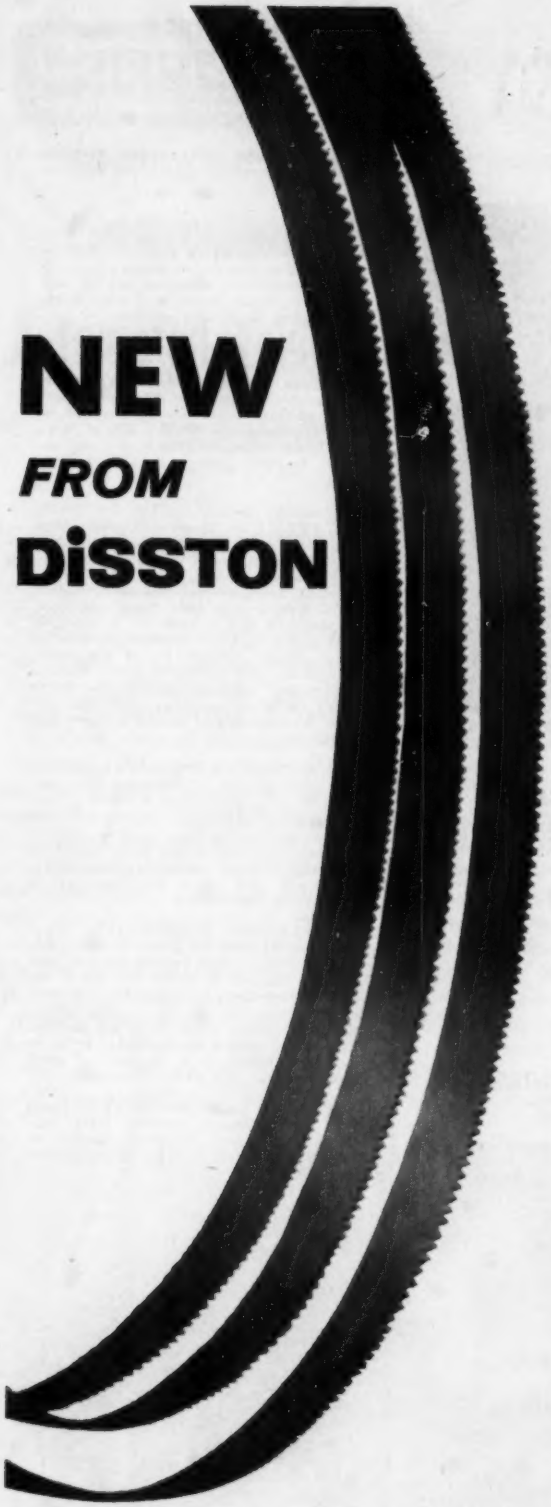
11 ELECTRONIC GAGE — *Taft-Peirce Manufacturing Co, Woonsocket, RI.* 12-page catalog 614 describes principles of electronic gaging and gives details on the Versachek and available auxiliary equipment for it. Basic Versachek equipment is pictured and discussed — the amplifier; the height gage or comparator stand; capsule; classifiers and differential gages; and multiple switching.

12 "POWER IN NUMBERS"—*Norden Division of United Aircraft Corp, 3501 Harbor Blvd, Costa Mesa, Calif.* 24-page illustrated brochure states in a short introduction that numerical control of machines is based on simple fundamentals that combine automatic measurement of distance with a pre-selected or programmed series of mechanical motions. This booklet explains how numerical control works and tells what it can do. In a section dealing with the why of numerical control, a job is outlined in detail; savings in fixtures, floor-to-floor time; and setup time are listed beside cost of the performance by standard method and numerical control.

13 INSPECTION OF HOT DIP GALVANIZED PRODUCTS — *American Zinc Institute, 292 Madison Ave, New York 17, NY.* 34-page inspection manual describes significant factors governing inspection, properties, specification, and purchasing of hot dip zinc coatings. Illustrated with photos, charts, and graphs, the manual describes the galvanizing process, discusses the metallurgical structure of zinc coatings, factors influencing adherence, effects of various conditions of the basis metal. ASTM recommendations for zinc coating weights are listed for different types of products and a detailed checklist for inspectors' acceptance, rejection, and recommended action, are some of the material included.

14 AIR-POWERED STRAIGHT GRINDERS—*Rotor Tool Co, 26300 Lakeland Blvd, Cleveland, Ohio.* 6-page bulletin SG gives specifications for the D-4 standard 4-in. and light-duty 6-in. grinders and buffers, the D-6 standard 6-in. and light-duty 8-in. units, and the D-8 series of heavy-duty 8-in. grinders and buffers equipped with internal blade motors. Internal bladed and external bladed types are

"He'd make a much better boss if he wasn't a soprano."



NEW *FROM* DISSTON

MOST ADVANCED HIGH SPEED STEEL BAND SAW BLADE AVAILABLE

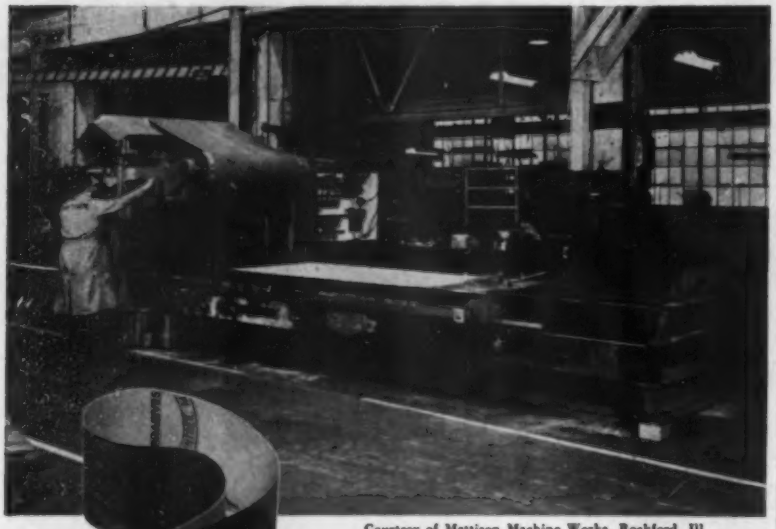
Four exclusive production *firsts* increase blade life 30 times over regular blades.

- **EXCLUSIVE "FLOW-SET"** — Newly developed equipment produces extremely precise setting of saw teeth. The precision "flow-set" evenly distributes the chip load to each set tooth. You get maximum cutting efficiency, smoother cuts and longer blade life — up to 30 times over that of regular blades.
- **EXCLUSIVE "UNI-HEAT"** — New heat treating units developed by Disston metallurgists consistently reproduce the delicately balanced combination of hard, wear-resistant teeth and a tough flexible back. Controlled hardening is maintained from coil to coil. You can cut 12 times faster and at higher temperatures with a Disston band. Production is actually increased.
- **EXCLUSIVE "FINE LINE" TEMPER** — New tempering furnace, electronically regulated, assures uniformity of tempering temperatures throughout. Each tempering cycle is sentry guarded. You get straighter cuts without danger of breaking from these unusually strong Disston bands.
- **EXCLUSIVE "LIFE WELD"** — New, specially built welding equipment is used in the joining of each Disston band. Perfect match of teeth, proper blade alignment and superior weld dressing give you a smoother running blade.
- **EXCLUSIVE "EXTRA SMOOTH"** — New satin finish means less friction guide drag and closer guide adjustment for straighter, truer cuts. Uniform coolant flow and minimum material build-up on side of blade.

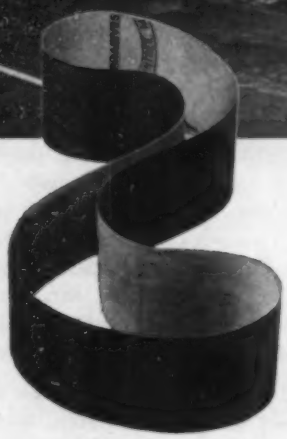
Add up these Disston exclusives — see why new Disston High Speed Steel Bands offer more for your money than any other blade!

DISSTON DIVISION PORTER ***H. K. PORTER COMPANY, INC.***

for a better finish and lower grinding cost, specify Jewel Brand abrasive belts



Courtesy of Mattison Machine Works, Rockford, Ill.



The Mattison No. 455 Wide-Belt Grinding and Polishing machine utilizes factory coated abrasive belts. It is designed to grind Stainless Steel and alloy sheets.

Today's modern machines are highly developed to produce at highest production speeds with uniform results and minimum costs. But one thing they can't do — they can't choose the right abrasive belt. That's why men who know metalworking specify Jewel Brand. They know, from experience, that Jewel Brand Abrasive Belts are built right to do the job — and do it well.

Why don't you specify Jewel Brand? You'll be assured of getting the right bond, the right backing, the right grain.

For a trial run, call your industrial distributor or write: Abrasive Products, Inc., South Braintree 85, Massachusetts.

JEWEL BRAND

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belts • rolls • sheets • discs • specialties

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

described together with spindles, grinding wheels, wire brushes, cone wheel adapters and hoses.

15 TOOLS—*Universal Vise & Tool Co, Parma, Mich.* 24-page catalog 1161CJ covers all of Universal's tools including the new Speedi-Spacer and B Series clamps as well as company's complete line of machine vises, rotary tables, and other workholding and positioning devices.

16 MICROMETERS—*J T Slocomb Co, 68 Matson Hill Rd, South Glastonbury, Conn.* Bulletin 11 describes a direct reading micrometer: the Speedmike; and the Snap Gage micrometer which may be used to eliminate an entire set of fixed snap gages. Includes information on optional features and optional terminals available.

17 SLIDE RULE GUIDE TO TOOL STEELS — *Universal-Cyclops Steel Corp, Bridgeville, Pa.* The Tool Steel Identifier, a compact slide rule, lists over 600 brand names, with producer, AISI number, and the Universal-Cyclops equivalent brand. Brands and AISI types are listed alphabetically and numerically. A complete AISI tool steel type classification table is shown on the reverse side of the chart. Included in this table are chemical composition and AISI designations for water hardening, shock resisting, cold and hot work, high-speed, and special purpose tool steels.

18 MACHINING COMPOUND—*Baker/Gubbins Co, 1448 Wabash Ave, Detroit 16, Mich.* Data sheet describes a new petrochemical derivative. Compound 576, claimed to have five times the film strength of straight oils. It is said to be especially adaptable to large central systems, rejects tramp oils, and causes low drag out on parts being machined.

19 ELECTRIC TACHOMETERS—*Electro-Mechano Co, 241 E Erie St, Milwaukee, Wis.* 4-page bulletin pictures and describes variety of models for use in industrial processing, production control, machine tools, marine equipment, laboratory and testing work. They are particularly useful where the indicator is to be located a distance from the point of speed measurement.

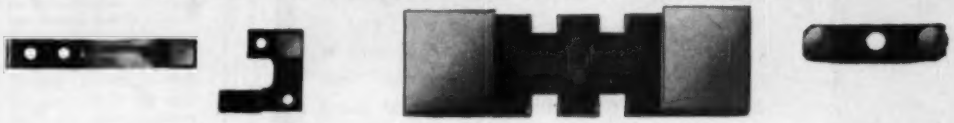
20 SOLID CARBIDE TOOLS — *Dexco Corp, Raymac Division, 15778 Telegraph Rd, Detroit 39, Mich.* Catalog 61 identifies each tool by type, series number,

"The wife wanted to fix something special—it's our first wedding anniversary!"

PRECISION Quarterly NUMBER 8

PRECISION WELDER AND FLEXOPRESS CORPORATION, 3520 Ibsen, Cincinnati 9, Ohio

Automated Welding Sure Way To Electrical Contact Economies



CHICAGO: Step into a progressive metalworking plant near here and you will find a line of 60 resistance welding machines fastening buttons.

Each month this one plant welds millions of electrical contact buttons to other electrical components. These buttons must be superior electrical conductors (which is why so many are made of fine silver), and above all, they must be reliable. This plant is achieving button-welding reliability of 999,996 perfect parts out of each million welded!

With understandable pride, we note that most of the machines in that reliable line are Magnetic Force welders built by Precision Welder & Flexopress Corp. of Cincinnati, Ohio. Precision is an old hand at reliable button welding.

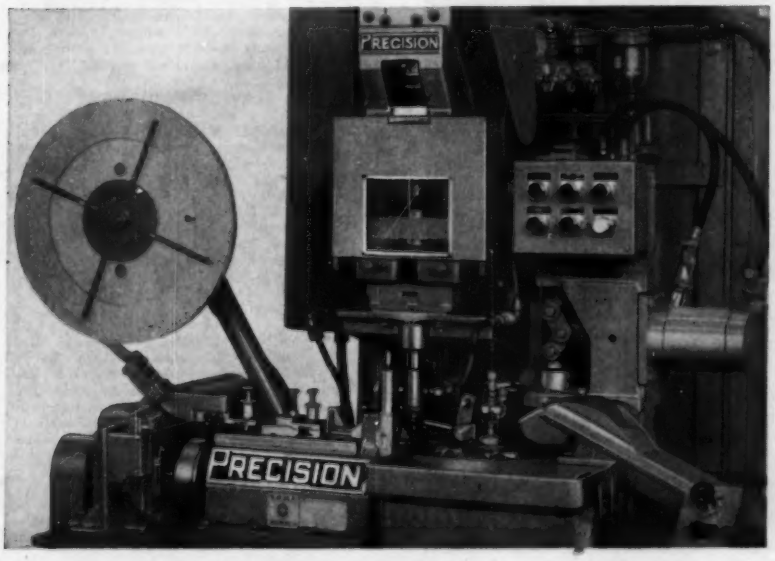
It's a big business, too. Your doorbell, thermostat, dishwasher, drier, toaster, waffle iron, telephone, and automobile would soon break down without reliable contacts. Industrial equipment is loaded with them.

Button welding can be tricky. Besides being difficult to weld directly to other materials, silver is costly. If you decrease the amount of silver and increase weldability by using contacts in which the silver is backed up with other metals, you often end up by increasing costs. However, a good proportion of our country's electrical manufacturing plants find that individual contacts of composite materials make sense for low volume production. Standard resistance welding machines can handle the work—whether welding, brazing, or silver soldering—on a slowpoke basis.

But when it comes to thousands of contacts a month, only welding automation (the kind pioneered by Precision) can really hold costs down. Contacts no longer have to be purchased ready-formed. Automated Precision Welders accept coiled ribbons of pure silver or composite materials, accurately measure and cut off contact blanks, orient them, assemble them to other components, weld the two together automatically, and coin to shape. Ingenious tooling can equip the same Precision machines to handle components of many different sizes and shapes.

In addition, Precision furnishes the electrical industry with Magnetic Force welders with hopper, magazine, dial, and in-line feeds for handling ready-formed contact buttons. You will also find Precision welders (and Flexopresses, too) doing the unusual and difficult jobs in automobile, appliance, communications, aircraft and many other metalworking categories.

If yours is a high-production welding task, or if it involves the welding of precious metals, dissimilar materials, large areas, or other out-of-the-ordinary situations, you ought to look into Precision. Especially if it's profits you're after. And who isn't?



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modern MACHINES *demand*

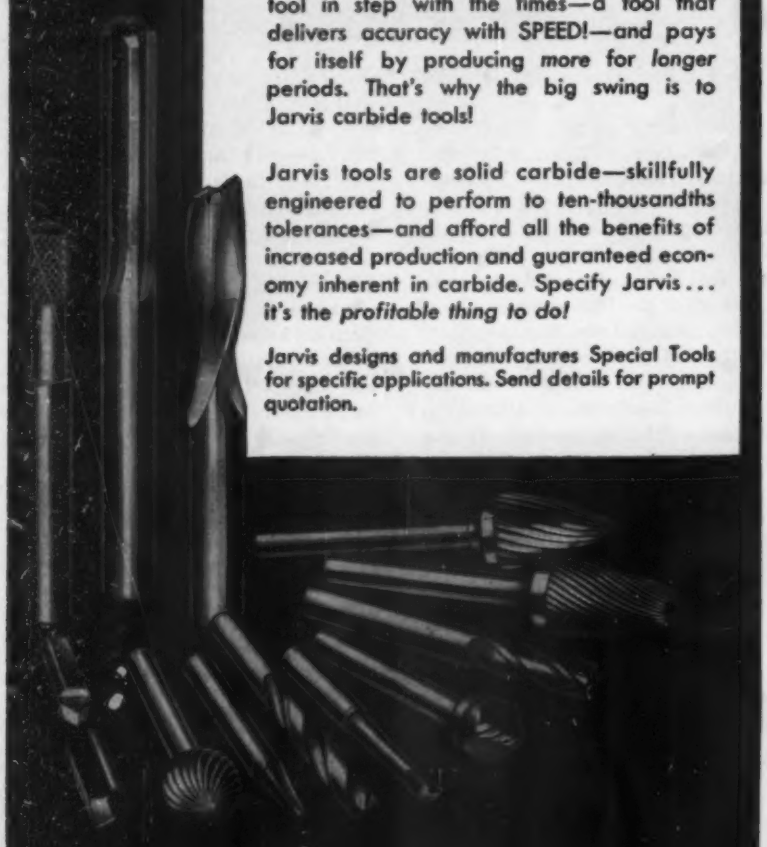
MODERN *solid carbide* **TOOLING!**

Jarvis SOLID CARBIDE GIVES MAXIMUM EFFICIENCY AND ECONOMY!

Forward-thinking management demands a tool in step with the times—a tool that delivers accuracy with SPEED!—and pays for itself by producing *more* for *longer* periods. That's why the big swing is to Jarvis carbide tools!

Jarvis tools are solid carbide—skillfully engineered to perform to ten-thousandths tolerances—and afford all the benefits of increased production and guaranteed economy inherent in carbide. Specify Jarvis... it's the *profitable thing to do!*

Jarvis designs and manufactures Special Tools for specific applications. Send details for prompt quotation.



NOTE: SOME AREAS ARE OPEN FOR REPRESENTATIVES OF OUR SOLID CARBIDE TOOLS

MULTIPLE SPINDLE DRILLING & TAPPING HEADS
HSS & CARBIDE TOOLS
TORQ-MATIC TAPPING HEADS
FLEXIBLE SHAFTS & MACHINES
HIGH SPEED STEEL TAPS
LEAD SCREW TAPPING HEADS

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Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

and dimensional specifications. New tools added include flat drill plastic routers, and an expanded line of boring bars. Speeds and feed charts, application information, and surface feet charts are included.

21 CUTTER GUARDS—*Royal Design & Manufacturing Inc, 4131 E Ten Mile Rd, Warren, Mich.* 2-page bulletin on Cy-Co-Trol cutter guards describes built-in safety features such as coated handles or holders, locking clamp, and side or vertical guard for ease in storing without need for individual tote boxes or hot dip plastic. These guards are available for any size cutter from 4 to 20 in. in diameter.

22 PUNCHES AND DIES—*Geo F Marchant Co, 1420 S Rockwell St, Chicago 8, Ill.* Revised edition of catalog 60 presents data on New Process punches, dies, rivet sets, and compression riveter dies of every size and shape. Items are illustrated by 145 sketches. Stock list shows complete selection of all tools.

HEAT TREATING AND WELDING

23 TWIN-FLOW OVEN—*Ramco Equipment Corp, Division of Randall Mfg Co, Electric Oven Div, 801 Edgewater Rd, New York 59, NY.* 4-page bulletin 960 covers twin circulation oven principle that provides uniform heat from all sides under full load conditions. Line includes standard and specialized batch, conveyor-belt, and monorail types. Charts and photos provide physical and performance data on standard and specialized units.

24 AUTOMATION IN SOLDERING AND BRAZING—*Fusion Engineering, 17921 Roseland Ave, Cleveland 12, Ohio.* 4-page brochure describes method of automating production soldering and brazing operations with paste alloys, discusses three series of paste materials available, and gives four case history examples of cost savings achieved through installation of automatic, semi-automatic, and manual equipment.

25 WELDING OF HY-80 STEEL—*Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* Reprint of an article (ADR 130) "All Position Welding of HY-80 Steel With the Gas-Shielded Process," illustrated with charts and photos, discusses all-position welding of the material with the dip-transfer gas-shielded process. Following a short introduction and historical summary of the subject, details are given on tests made in applying techniques to HY-80 steel and their results.

PLANT SERVICE EQUIPMENT

26 BARREL FINISHING—*Norton Co, Worcester 5, Mass.* 96-page revised edition (Form 501) includes descriptions of the various barrel finishing processes, recommendations of different abrasive shapes and sizes for applications in which they are best suited, case histories of actual uses, description of all types of equipment available, discussion of compounds and their effects, and a section devoted to practical suggestions on operating procedures.

27 MASK WASHING—*Conforming Matrix Corp, 758 New York Ave, Toledo 11, Ohio.* Illustrated brochure gives description of five automatic machines for washing masks used in spray paint decoration. Full range of sizes includes portable Model W-1500-S for small masks up through Model W-7200 for largest sizes.

28 ULTRASONIC DEGREASING — *Phillips Manufacturing Co, 2475 W Touhy Ave, Chicago 45, Ill.* 8-page illustrated catalog 28 provides information on

applications and equipment, describes features of tank transducers and ultrasonic generators for use in large and small scale degreasing operations. Provides specifications and applications of all of the manufacturer's electrosonic models including generators, tanks, recirculating filters, rinses, and dryers.

29 PIPE AND TUBING MEASUREMENT — *Aeroquip Corp, Jackson, Mich.* 16-page booklet 631 supplies standard methods of measurements, discusses both the similarities and differences involved in measuring various fittings and fluid-carrying lines in order to arrive at satisfactory fluid line installations. Covers standard practices of measuring adapters and complete assemblies; dash numbering systems commonly used in pipe and tubing measurements are explained in chart form.

30 METAL CLEANER — *MacDermid Inc, Waterbury, Conn.* Technical data sheet 40 provides information on Metex T-103, designed to remove oil and grease from steel, copper, and brass. Contains latest recommended operating conditions, suggested cleaning cycles, and control procedures.

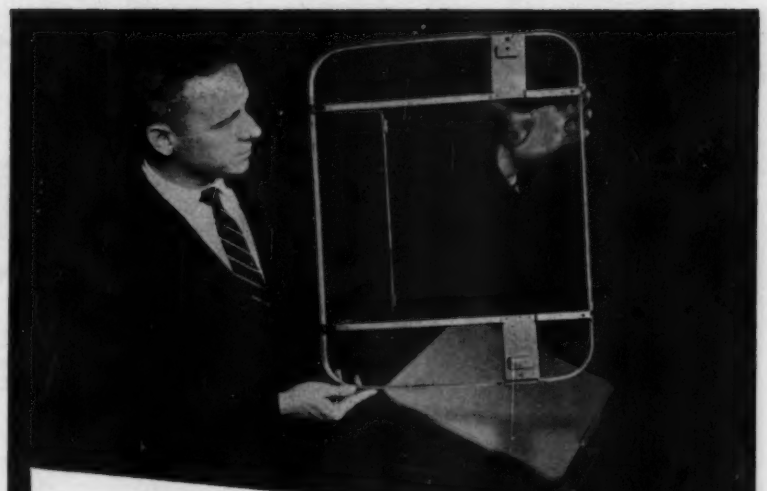
31 MOBILE SCALE—*Hydroway Scales Inc, PO Box 531, Oakridge Station, Royal Oak, Mich.* 4-page bulletin 161 covers the Hydroscale, a platform scale that will attach to any fork lift truck. Available in capacities from 1000 to 6000 lb, it will lift and weigh in one operation. Models, capacities, and prices, plus optional mountings and models for batching are described.

PARTS AND MATERIALS

32 INDUSTRIAL PLASTICS—*Marbon Chemical Division, Borg - Warner Corp, Dept C-2, Box 68, Washington, W Va.* 12-page report compares major properties offered by nine leading industrial plastics, including Marbon's Cycolac brand polymers, and eight others. Graphs demonstrate performance; six separate graphs compare the plastics for overall performance in these areas: cost, measured in cubic inches per dollar; heat deflection at 264 psi; impact strength at room temperatures; impact at low temperature; tensile modulus or rigidity; and hardness. A seventh, cumulative properties comparison chart, indicates the total performance value for each of the nine plastics.

33 SILICONES — *Union Carbide Corp, Silicones Div, 270 Park Ave, New York 17, NY.* 16-page booklet contains most recent information; illustrates with photos, charts, and graphs the properties and features of UC silicone fluids, resins, rubber compounds, water repellents, antifoams and emulsions, and their adaptability for use in wide range of industries. ●

"I'll say this is a welcome bonus! Especially so—since I don't even work here!"



American Seating uses

FEDERAL-WARCO

American Seating Company, world's largest manufacturer of fine institutional furniture, makes Federal-Warco dependability a part of its operations. A Federal multi-spot resistance welder helps American Seating make structural members for advanced-design seating products like the new Study-Center® classroom desk above.

Wherever expert metalworking is performed, you'll find Federal-Warco contributing to speed, precision and quality workmanship.

Federal builds a complete line of resistance welders. Consult your nearest Federal representative, or write us direct. Ask for new booklet on special welders.

THE FEDERAL MACHINE AND WELDER COMPANY

A Subsidiary of The McKay Machine Company

WARREN, OHIO

Federal® WELDERS

Warco® PRESSES

STRIPPIT self-contained units are the most efficient, most economical method of punching holes in metal. That's why Boeing Airplane Company has utilized thousands of them in the production tooling for the latest, most devastating version of the famous Stratofortress.

STRIPPIT Units consist of holders containing the punches, dies, stripping guides and stripping springs. Any good mechanic can quickly set up these units to punch the pattern of holes desired. The "C" Unit shown here, for instance, is ideal for close center-to-center rivet holes in wing and fuselage sections. This "C" Unit also features a pedestal die for punching holes in angles, channels, shapes and extrusions.

All STRIPPIT Units are independent, self-contained and self-stripping. They provide permanent alignment of punches and dies for precise hole positioning. There are a tremendous variety of STRIPPIT Units with capacities up to 3.5" hole diameters and ¼" thick material.

Find out how The STRIPPIT System can speed your production and cut your press "down-time" to a minimum. Write now for free catalog.

WALES **STRIPPIT** INC.
200 Buell Road • Akron, New York

UNIT OF HOUDAILLE INDUSTRIES INC

In Canada: Strippit Tool & Machine Company, Brampton, Ont.; In Continental Europe: Raskin, S. A., Lausanne, Switzerland; In the British Isles: E. H. Jones (Machine Tools) Ltd., Hove, Sussex, England.

NEW BOOKS...

SMALL PLANT MANAGEMENT—*Edited by W A MacCrehan, Jr. Prepared under the auspices of the Management Div, American Society of Mechanical Engineers. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, NY. Second edition. 560 pages, 6 by 9 in. Price* $10.50

A revised edition of a work that first appeared in 1950, this book is based on a study (conducted by the Small Plant Committee of the ASME) of small-plant activities in several industries.

Of necessity the coverage here is general, that is, not every small-plant manager will find concrete clues here to successful running of his business. But the book does attempt to present practical aspects of management—more successfully so in some chapters than others.

Written by authorities in their fields, the book covers such areas as finances, organization and operation, legal requirements, labor relations, taxes, productivity. Numerous checklists and charts (there are over 400 illustrations) are helpful here.

In sum, this new work is a good jumping-off place for a broad, overall view of small-plant management, before the narrower but deeper plunge into specialized segments of management—TJ

HOW TO CHART DATA—*By Phil Carroll. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, NY. 250 pages, 6 by 9 in. Price* $7.50

This very useful book proves, in very readable fashion, that charts are often the best way to explain to others the solutions to complex problems. The author's thesis: "Anyone who can add two plus two and get the right answer can make charts to solve very complex problems." After reading his book, we agree that his statement is no exaggeration.

Basically, the book examines—in detail—the following forms of charting: straight-line curves, lists of data, straight-line equations, two-way charts, nomographs, family of curves, and multi-variable charts. In each, the reader receives the A-to-Z view of charting techniques, in which the right and wrong approaches are carefully spelled out.

Anyone who wants to learn how to make a nomograph, or to chart time-study data, or to plot graphs that combine two or more variables, will find the techniques here—TJ

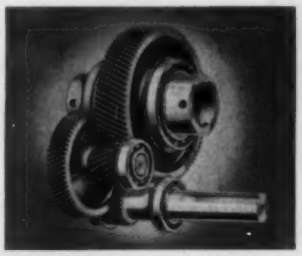
... the quality-engineered package

that simplifies speed reduction

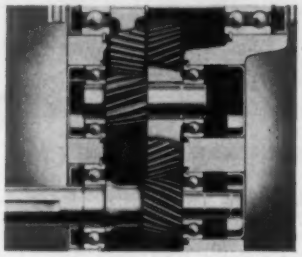
DODGE TORQUE-ARM, America's most widely used shaft mounted speed reducer, will save money for *you.* No foundation, no sliding motor base, no flexible coupling, no installation fuss. Developed and perfected by Dodge, this reducer has been so widely accepted in industry that it is now built and stocked in this unmatched range of sizes and models: capacities up to 170 hp; output speeds from 10 to 400 rpm; ratios of 5:1, 15:1, 25:1; speed ratios up to 175 to 1 with correct selection of speed reducer and V-belt drive. Built-in backstop available. Also positive overload release. Vertical models. Flange mounted models. Special application models . . . Go modern—go Torque-Arm! See your Dodge Distributor, or write us.

Dodge Manufacturing Corporation, 100 Union St., Mishawaka, Ind.

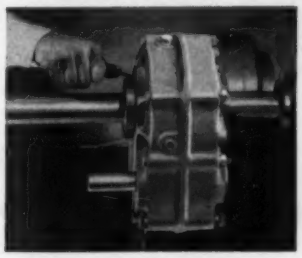
Rugged, semisteel housing holds bearing seats in line for entire life of unit. Laughs at loads. Corrosion resistant.



AGMA rated helical gears. Soft cores withstand shock; hardened surfaces defy wear. Teeth are crown shaved.



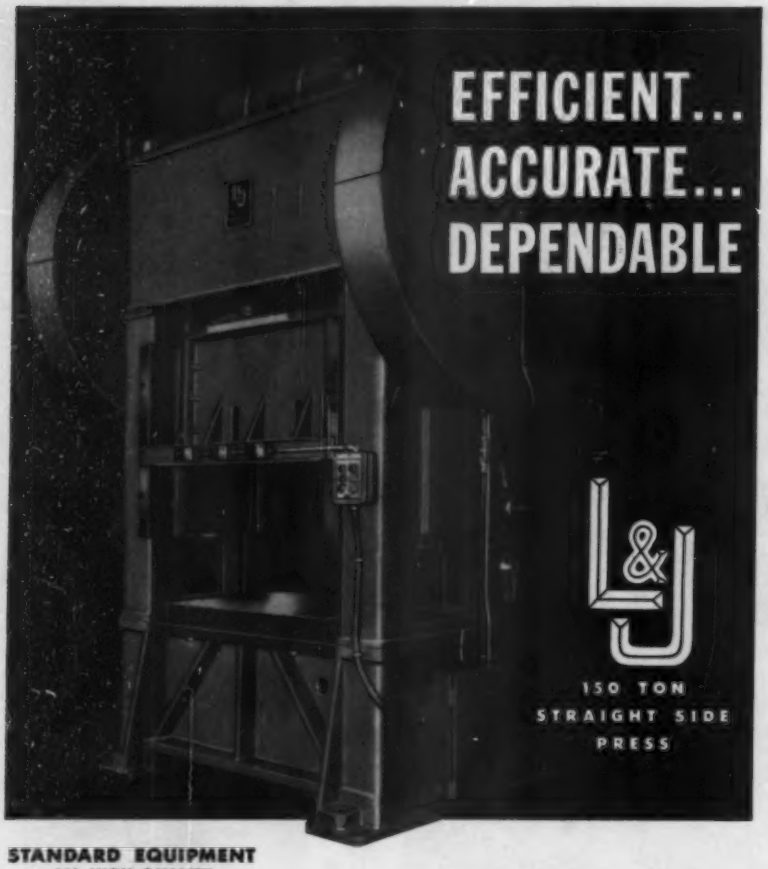
Gears are located *between* bearings and carry their loads without strain. Longer life, higher efficiency.



Unit slides completely onto shaft and locks on *both* sides of housing. This baby stays *put*—runs truer longer.

The Products with the Pluses... **DODGE** *of Mishawaka, Ind.*

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge he can give you valuable assistance on new cost-saving methods.



STANDARD EQUIPMENT
ALL HIGH QUALITY

Including—Air clutch. I.I.C. wiring and controls. Shaft driven limit switch. Solenoid-controlled dual air valve. Replaceable wear strips on slide. Hard bronze crankshaft bearings. Replaceable ball seats. Air counter balances on slide. One-shot forced lubrication. Gears run in oil. *Optional equipment as required.*

- **Single geared, twin end drive, double crank.**
- **Maximum quality throughout.**
- **Long, square gibbing maintains perfect slide alignment.**
- **Heavy welded steel box-type frame with tensioned tie rods insures rigidity.**
- **Proven L & J quality gives long, dependable service and cuts maintenance costs.**
- **Large die space — 48" x 36" slide face, 48" x 36" bolster area.**

WRITE for complete information on 20- to 150-ton straight side presses, 14- to 150-ton O.B.I. presses and 30- to 75-ton gap frame presses.

L & J PRESS CORPORATION 1629 STERLING AVE. ELKHART, IND.

CIRCLE 366 READER SERVICE CARD

MODEL D

SHORE SCLEROSCOPE HARDNESS TESTERS

Pioneer American Standard SINCE 1907

Available in Model C-2 direct reading or in Model D dial indicating with equivalent Brinell and Rockwell C Hardness Numbers. May be used free hand or mounted on bench clamp. Sensitive over entire range from softest to hardest of metals without adjustment. Non-injurious to work.

OVER 40,000 IN USE

THE SHORE INSTRUMENT & MFG. CO., INC.
90-35B Van Wyck Exp.
Jamaica 35, N. Y.

NEW FILMS...

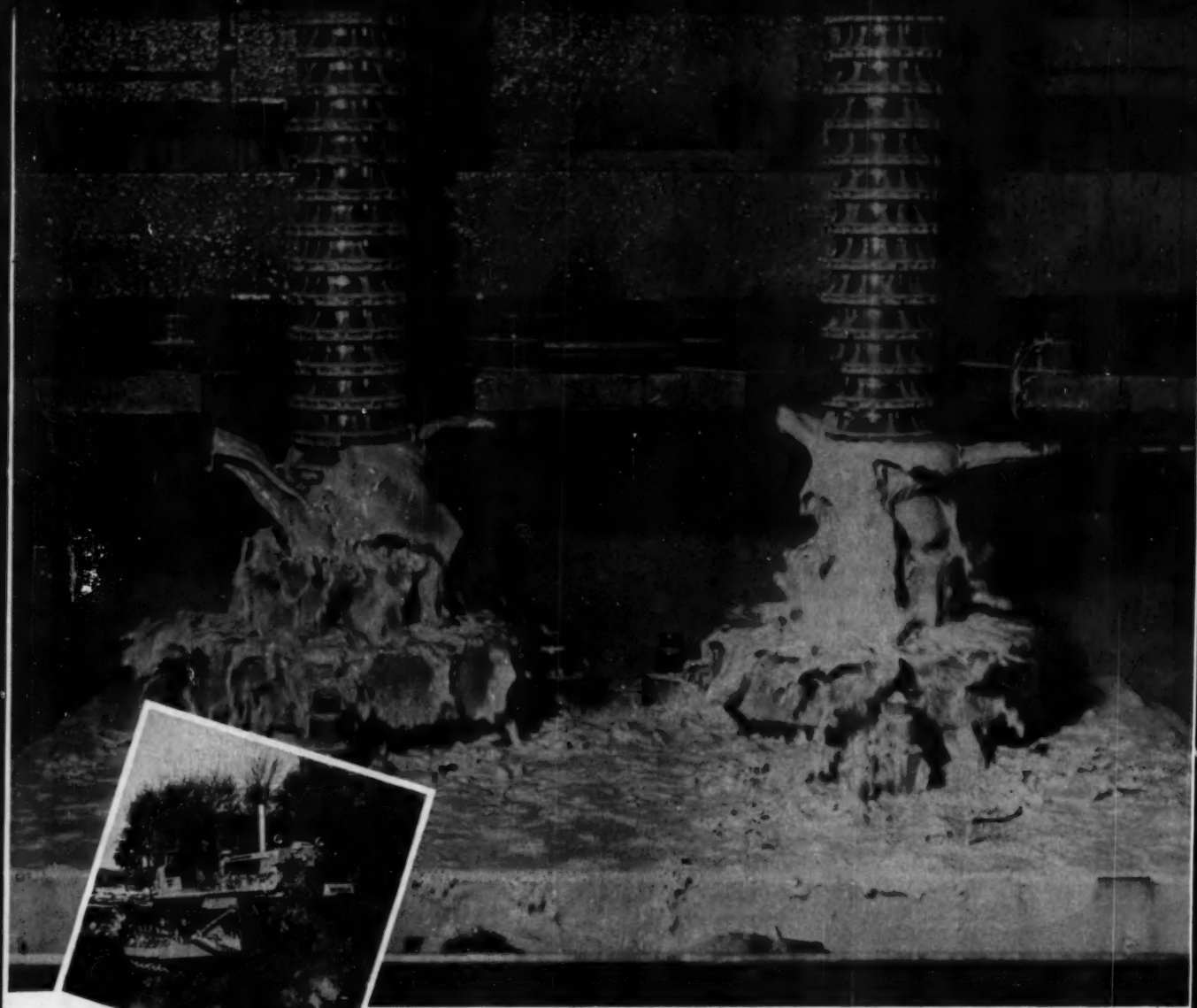
MOVIES AT WORK. *Produced by Eastman Kodak Co, Rochester 4, NY. 16 mm, sound, color. Running time 14 min. No charge.*

To show many of the ways in which motion pictures can serve industry, this new film demonstrates that do-it-yourself movies made with a 16 mm camera can solve many communications problems. Among the uses illustrated are safety instruction, time-motion analysis of specific jobs, slow-motion studies of machine operations to pinpoint trouble spots, training of new employees, and training of regular employees in new procedures. A particular advantage is that the narration can be made by the workers' own foreman. Other uses include sales and supervisory training, time-lapse photography for traffic study and for determining the most efficient use of plant space.

AUTOMATIC CAREER. *Produced by Nat'l Screw Machine Products Ass'n. 2860 E 130 St, Cleveland 15, Ohio. 16mm, sound, color. Running time 20 min To be available in Feb, 1961. No charge.*

Designed for school use in shop and mechanical courses, this lightly technical film shows how the automatic screw machine operates, what it makes, and how it fits into industry. It should be shown to students who already have a basic knowledge of metalworking practice, particularly with lathes, milling machines, and similar equipment. It can also serve, however, as a vocational guidance vehicle to aid industrial arts instructors and guidance counselors by showing students how a young man with mechanical ability and training can find a secure future in the screw machine products industry.

"Why, son, I can remember when you had to push three buttons instead of only one to run this machine."



Caterpillar D-7 Series D Tractor with 7A Cable-controlled dozer

Broaching a spline in gear blanks of 4100 Series grade steel with a Colonial Broach Machine using Kerns Soluble Cutting Fluid at Caterpillar Tractor Co., Peoria, Ill.

IMPROVE YOUR BROACHING OPERATIONS...

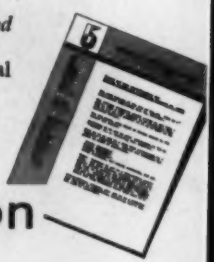
like Caterpillar Tractor Co. did by changing to a *specialized* water soluble cutting fluid. This tailored lubricant by Kerns United keeps parts exceptionally cool, cuts down tool expansion providing greater consistency through the day with little or no welding of chips to cutting edge.

Kerns lubricant proved cleaner around machine area with much less dragout of material. For instance . . . prior to the Kerns product, parts were heavily coated, hard to handle and required a pre-assembly wash operation. Kerns eliminated wash operations and parts now can be easily handled by hand.

Consult Kerns United now . . . work with industrial lubricants that are tailored to meet your requirements at a savings . . . investigate Kerns Memo Billing Trial Basis that provides for no formal billing until proven in production.

Manufacturers of Cutting, Grinding, Drawing, Forging, Phosphatizing, Cleaning, Wire Drawing and Spray Booth Compounds; Cling Oils, Rolling Oils, Rust Preventives and Specialized Greases.

Write now for further information on any one of these products and/or Kerns Memo Billing Trial Basis . . . no obligation of course.



World's largest Exclusive Manufacturer of Specialized Industrial Lubricants.

KERNS UNITED Corporation

2659 East 95th Street • Chicago 17, Illinois

Subsidiary: KERNS PACIFIC Corporation, *630 N. Batavia St., Orange, California*

Offices in Principal Cities throughout the U.S.A.

CIRCLE 368 READER SERVICE CARD

GOOD ON YOUR LATHES...

VERY GOOD FOR YOUR TURNING COSTS

Multi-Duty models for light work and general use. Rigid, accurate. Interchangeable male, female and pipe points.

ACCURATE

IDEAL LIVE CENTERS

4 complete lines. Over 40 sizes and styles.
All popular tapers for heaviest to lightest work.

If you turn metal, it's just good operating sense to save money with Ideal Live Centers. You'll get accuracy to meet your stated standards, at your turning level and at lowest center point costs. You'll reduce your inventory costs with fast delivery from Ideal distributor stocks. State your requirements, as tight as you like. He'll meet them exactly with the Multi-Duty, Universal, Heavy-Duty or Pipe Point model right for your job. For custom quality at production prices, call on him for all your live center needs.

Sold through Leading Industrial Distributors

In Canada: IRVING SMITH, Ltd., Montreal

IDEAL INDUSTRIES, Inc.
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Sycamore, Illinois

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Ettco DRILLING and TAPPING

Lead Screw tapping attachments and heads

Here's precision production! Complete uniformity with unskilled labor. The result is speed, accuracy and economy, regardless of quantity.

Complete Line-Ettco has the tool for your single or multiple small hole production job.

ETTCO TOOL AND MACHINE CO., Brooklyn 37, N. Y.

CIRCLE 370 READER SERVICE CARD

PRECISION SET-UP FOR PRECISION GRINDING WITH

ANTON MAGNETIC ADJUSTABLE V-BLOCK

Unsurpassed for layout, toolroom and production. Can be used on any machine equipped with magnetic chucks.

SAVE MONEY, TIME AND LABOR

- Vernier accuracy: .15 seconds
- Parallelism: .00005 over entire length
- Size: 4" long, 4½" wide, 2½" high

Write today for complete technical data to:

ANTON MACHINE WORKS
1226 Flushing Avenue
Brooklyn 37, N. Y.

CIRCLE 371 READER SERVICE CARD

An Economical Approach to Small Parts Inspection

ROBINS (model SG-66) SYL·A·SCOPE

Here, at last, is an instrument that provides rapid, precise inspections of small parts and tools up to 1/32" in diameter. Completely portable, the SG-66 can be transferred easily for on-the-spot inspections. Its low price permits the purchase of enough units to cover every critical inspection point in your plant . . .

The SYL-A-SCOPE is easy to operate: Simply plug it in to any standard electrical outlet — place the part to be inspected in the aperture — and switch it on. Instantly an illuminated, magnified silhouette (80 to 1 linear magnification) appears on the ground glass screen . . . highlighting every detail.

Specifications: Power Requirements—110 VAC, 60 cycles; Screen Size—2⅝"x2¼"; Dimensions —7"x5¼"x3⅞"; Sturdy Metal Case.

only $19.95

Write for literature. AM-3

ROBINS INDUSTRIES CORP. • FLUSHING 54, N. Y.

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GEARING FOR PROFITS?

Check Your Gear & Rack Requirements with Braun First!

The direct action of sending prints with a request for quotation costs you nothing and may mean new savings for you in your gear purchases.

Send for our explanatory brochure "Gearing For Profits."

BG

BRAUN GEAR COMPANY
243 Richmond Street
Brooklyn 8, New York

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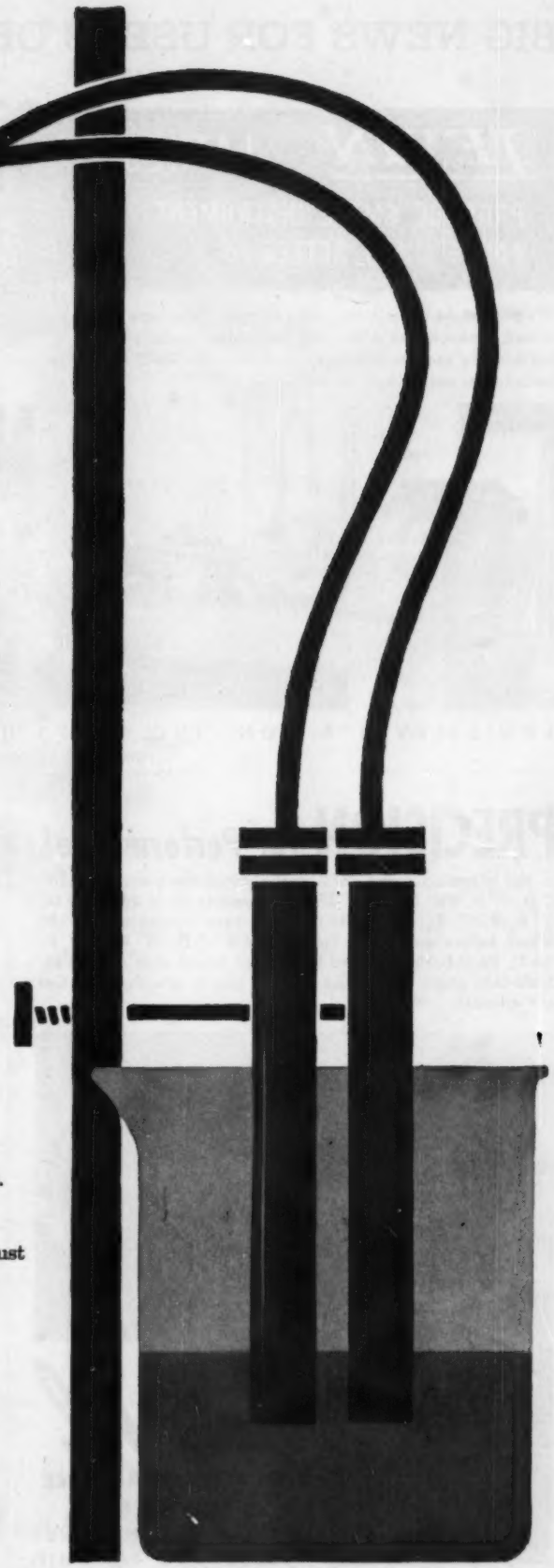

pH 7

some facts about the first truly neutral, high performance trichlorethylene

Columbia-Southern's improved Trichlor makes your job easier, your cleaning better and your costs lower.

Here are the facts:

Longer life and greater stability—proved by actual operation.
Result: Lower cleaning costs—more metal degreased per pound of Columbia-Southern Trichlor.

Rugged stabilization—helps prevent contaminant break-down.
Result: Lower maintenance costs—less sludge formation and longer operating time between clean-outs.

Alkalinity—closer to neutral than any other degreasing trichlorethylene.
Result: Better control in alkaline sensitive operations.

High acid acceptance—highest average acid acceptance of any commercially available trichlorethylene.
Result: Greater protection against acid contaminants.

pH Control—less pH variance in operation.
Result: More consistent metal surface conditioning.

Copper corrosion—none in hot or cold systems.
Result: No losses from copper tarnishing.

Compatibility—compatible with other trichlorethylenes.

Extensive field testing proves that Columbia-Southern's truly neutral trichlorethylene is adequately stabilized for the most critical degreasing operation. Want to see just how this new Columbia-Southern Trichlor can improve your operation? Contact your Columbia-Southern Representative.

columbia | southern chemicals
CHEMICAL DIVISION
PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER PITTSBURGH 22, PENNSYLVANIA
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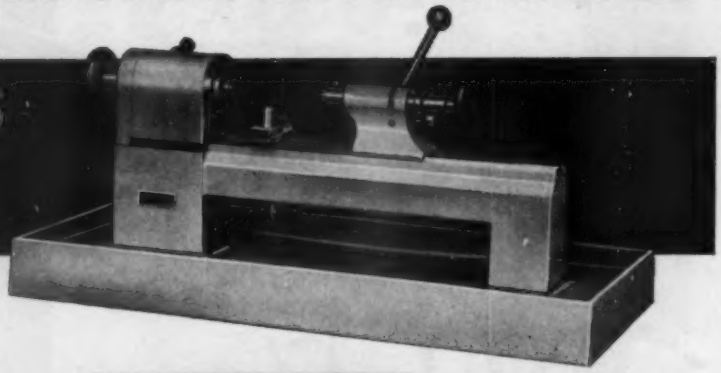
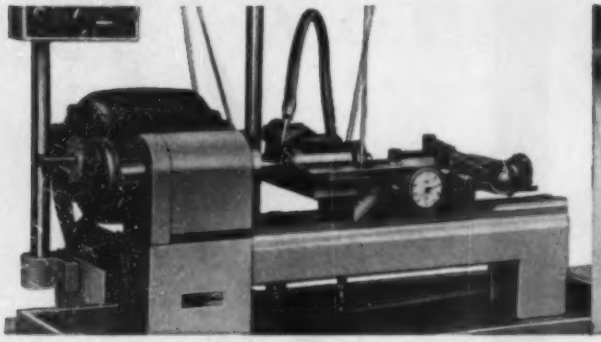
BIG NEWS FOR USERS OF INSTRUMENT LATHES

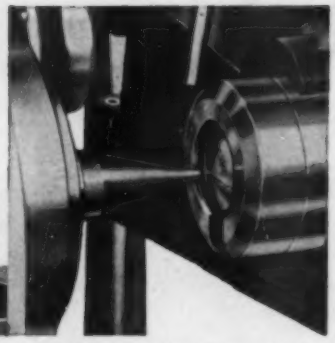
LEVIN LATHES

PRODUCE SMALL INSTRUMENT PARTS MUCH BETTER



We present the latest in the series of Levin Instrument Lathes, a new model with a half inch collet capacity but with the same sensitivity and precision for which Levin Lathes are so well known.





Here is a typical example of work which can be done in the new Levin ½" capacity lathe. A hole .002" in diameter is being drilled in a nozzle.

Send for literature describing the ½" capacity instrument lathe and accessories.

LOUIS LEVIN & SON, INC., 3573 HAYDEN AVE., CULVER CITY, CALIF.

CIRCLE 375 READER SERVICE CARD

PRECISION *for Performance!*

In this gleaming group are 2 steel herringbone gears of 28.24" O.D., 6" F., 9¾" B., 69 T., 2½ D.P.—another set of 28.24" O.D., 6" F., 10½" B., 69 T., 2½ D.P. All heat treated to 240-350 Brinell before machining. Pinions—14.4" O.D., 6" F., 7½" B., 36 T., 2½ D.P. Heat treated to 385-400 Brinell after completion. Stahl-built gears measure up—to the job, to specifications. Get our estimate.

SPURS TO 72" PD 1 DP
BEVELS TO 54" PD 1 DP
SPIRAL, HELICAL and WORM GEARS TO 48" PD 2 DP
CONTINUOUS TOOTH HERRINGBONE 2" TO 60" PD 3 DP
SPROCKETS TO 72" PD 2" DP
RACKS TO 20 FT. LONG 3 DP
SILENT GEARS RAWHIDE BAKELITE FIBROID
HEAT-TREATED, CASE OR FLAME HARDENED GEARS—OF ZAGRON OR ALLOY STEEL

Stahl

GEAR & MACHINE COMPANY

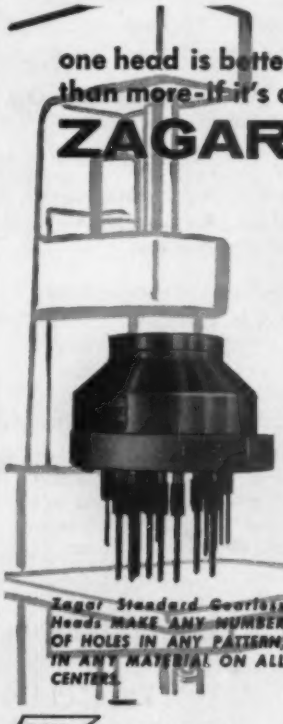
3901 HAMILTON AVENUE

CLEVELAND 14, OHIO

---

one head is better than more-if it's a

ZAGAR Head for Drilling, Reaming and Tapping



Zagar Standard Gearless Heads MAKE ANY NUMBER OF HOLES IN ANY PATTERN, IN ANY MATERIAL ON ALL CENTERS.

1 to 1000 holes in one pass—as close as twice drill diameter. Costs decrease as spindles are added. *And,* a variety of hole patterns (or parts) can be produced with *one fixed center head.* Zagar units are adaptable to standard drill presses or are built as a complete installation. Send in your hole problem to Zagar.

Write for Manual "A-3" for engineering data.

23886 Lakeland Blvd. Cleveland 23, Ohio

Zagar INCORPORATED

USE MORE SPINDLES TO DO MORE WORK

CIRCLE 393 READER SERVICE CARD

BETTER PROFITS THROUGH BETTER TOOLING WITH CARBOLOY® CARBIDE PLUSES

CARBOLOY®, THE METALLIC VITAMIN FOR INDUSTRY

Carboloy cemented carbide disposable inserts . . . the metallic vitamins of industry . . . demonstrate their superior quality in the bonus work output per cutting edge. Multiple reasons explain their efficiency. One important factor is pre-honing a precise radius around the complete perimeter of the cutting edges. This factory process is designed to reduce chipping and increase predictable tool life. Worthwhile savings in time and money result.

For steel-cutting applications, Carboloy inserts are available pre-honed. All Series 78 grades for normal steel cutting come pre-honed. The 300 Series for heavy-duty applications are available pre-honed, precision-ground or utility-ground. Like to know more about these features, designed to help you gain *better profits through better tooling?* Call your Authorized Carboloy Distributor or write: *Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Street, Detroit 32, Michigan.*

CARBOLOY. CEMENTED CARBIDES

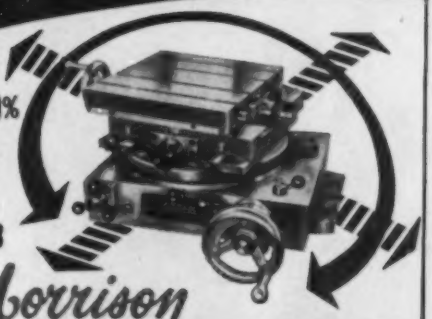
METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

NOW ALL MILLING MACHINE OPERATIONS ...WITH **ONE SET-UP!**

50% to 90% TIME SAVED ON EACH JOB

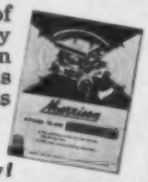


Morrison

CROSS/SLIDE ROTARY TABLE

This rugged, precision-built tool will save you up to 90% of your normal set-up time, depending on the complexity of the job.

No unclamping and reclamping of the work-piece is necessary. Simply dial your work to each new position in seconds. No special training is needed for operation. No layout is necessary on the work-piece.



Send for descriptive literature and prices today!

MORRISON MACHINERY & ENGINEERING CORP.

935 W. Lake St., Dept. AM, Chicago 7, Ill.

CIRCLE 378 READER SERVICE CARD

JONES #4800

Hand Tachometer

BROAD RANGE
50 — 50,000 R.P.M.
with stop button

assures better production

HIGHER OUTPUT — QUALITY CONTROL obtained by maintaining proper machine speeds. Also helps avoid breakdowns by detecting irregularities.

CARRY IT FROM JOB TO JOB and keep it handy for quick, accurate tests. Choice of readings in R.P.M., F.P.M., etc.

GUARANTEED ACCURACY—superior construction, trouble-free. Unaffected by moisture, temperatures, electric currents.

Many other Portable and Stationary Models are available for use on all types of industrial machines.

Write for catalog W

JONES MOTROLA CORP.
Stamford, Conn.

CIRCLE 379 READER SERVICE CARD

A Grieder Tube Cut-Off Machine will produce 4500 to 6500 cut-offs per hour

Grieder Tube Cut-Off Machines are 3 to 8 times faster than others, and speed is only one of the cost saving advantages they provide. For example:

- $ Cut tubing of any shape to any length—steel, copper, brass, aluminum and alloys. Continuous automatic operation.
- $ Lengths can be held to plus or minus .002" on light wall tubing and to .003" on heavier.
- $ Precision clamping dies prevent tube distortion and produce a quality cut. Tube does not rotate.
- $ Thousands of cuts without grinding. Blades can be sharpened on standard tool room equipment and used for as many as a million cuts.

Write for literature, stating tube sizes and production requirements.

Grieder
TUBE CUT-OFF MACHINES

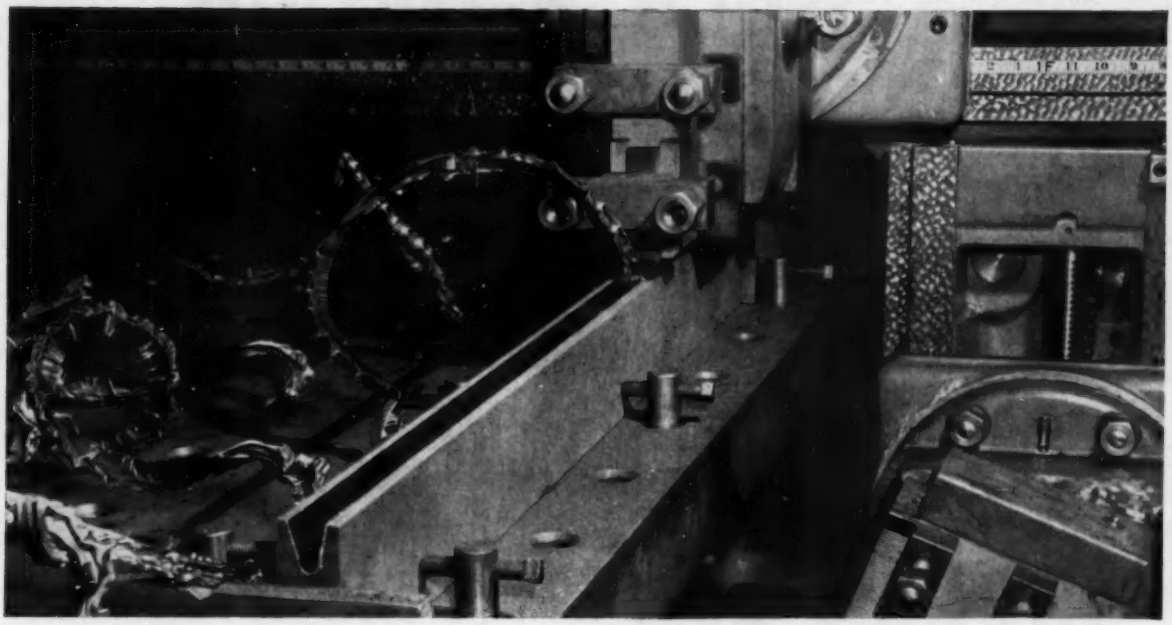
GRIEDER INDUSTRIES, INC.
P. O. Box 169 • Bowling Green, Ohio

Please send bulletin describing Grieder Tube Cut-Off Machines.

NAME_____
COMPANY_____
CITY_____ ZONE____
STATE_____

It's easy to use...

CARBIDE TOOLS EFFICIENTLY



on RMT shaper-planers

- Hydraulic Drive Absorbs Shock to Carbide Tools
- Maximum Strokes Per Minute Possible — acceleration and deceleration provided within short table travel through hydraulic power
- Hydraulic Pressure Holds Steady Cutting Speed at Rate Selected

These efficiency factors also provide lower-cost operation!

Fast Set Up — Quick To Respond — complete control of machine directly from operator's position.

Any Cutting Speed is Readily Obtained.

Feeds Are Infinitely Adjustable Throughout Specified Range.

Full Speed at Peak HP Reached More Quickly with Hydraulic Power.

Get Full Details and Specifications
Write Dept. M461

ROCKFORD MACHINE TOOL CO., ROCKFORD, ILLINOIS

WHAT HAPPENS WHEN A NATION SPENDS MORE ON GAMBLING THAN IT SPENDS FOR HIGHER EDUCATION?

If you can find any Romans around, ask them. They lived pretty high on the hog in their day. That is, until some serious-minded neighbors from up North moved in. The rest is ancient history.

You'd think their fate would have taught us a lesson.

Yet today we Americans spend twenty billion dollars a year for legalized gambling, while we spend a niggardly four-and-a-half billion for higher education. Think of it! Over four times as much! We also spend six-and-a-half billion dollars a year for tobacco, nine billion dollars for alcoholic beverages, and billions more on other non-essentials.

Can't we read the handwriting on the wall?

Our very survival depends on the ability of our colleges and universities to continue to turn out thinking men and women. Yet today many of these fine institutions are hard put to make ends meet. Faculty salaries, generally, are so low that qualified teachers are leaving the campus in alarming numbers for better-paying jobs elsewhere.

In the face of this frightening trend, experts estimate that by 1970 college applications will have doubled.

If we are to keep our place among the leading nations of the world, we must do something about this grim situation before it is too late. The tuition usually paid by a college student covers less than half the actual cost of his education. The balance must somehow be made up by the institution. To meet this deficit even the most heavily endowed colleges and universities have to depend upon the generosity of alumni and public spirited citizens. In other words, they depend upon *you.*

For the sake of our country and our children, won't you do your part? Support the college of your choice *today.* Help it to prepare to meet the challenge of tomorrow. The rewards will be greater than you think.

It's important for you to know what the impending college crisis means to you. Write for a free booklet to HIGHER EDUCATION, Box 36, Times Square Station, New York 36, New York.

ADVERTISING COUNCIL PUBLIC SERVICE

Sponsored as a public service in co-operation with The Council for Financial Aid to Education

HIGHER EDUCATION KEEP IT BRIGHT

SEARCHLIGHT SECTION

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Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name indicates the products or services offered by the advertiser.

1. Accessories
3. Automatics
7. Boring Mills
8. Broaching Machines
11. Chucking Machines
14. Cutting Off Machines
17. Drilling & Reaming Machines
18. Electric Motors
26. Grinding Machines
28. Honing & Lapping Machines
31. Lathes
37. Milling Machines
42. Planers
44. Power Equipment
45. Press Brakes
46. Presses
51. Roll Formers
53. Saws
57. Shears
66. Welding Equipment

ADVERTISER	Page No.	KEY TO PRODUCTS OR SERVICES
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"No Cost or Obligation"

This service is aimed at helping you, the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

How to use: Check the dealer ads to see if what you want is currently advertised. If not, send us the specifications of the equipment and/or components wanted on the coupon below, or on your own company letterhead to

SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o American Machinist/Metalworking Manufacturing
Classified Advertising Division, P.O. Box 12, N. Y. 36, N.Y.

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

Searchlight Equipment Locating Service, c/o Classified Advertising
American Machinist/Metalworking Manufacturing, Box 12, N.Y. 36, N.Y.

Please help us locate the following equipment:

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NAME.....

TITLE..... COMPANY.....

STREET.....

CITY..... ZONE ..... STATE.....

3/20/61

"MIDWESTERN"
OFFERS "GUARANTEED" MACHINE TOOLS—

RBG = Rebuilt Condition Guaranteed
RCG = Reconditioned—Guaranteed
*Indicates 1940+ Model **Indicates 1950+

AUTOMATICS
*9/16"—6 spdl Acme RA6 w/Thrdg & Tlg $ 4,950.
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FOREMATICS
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**12 Spdl—#46 Bausch Drills & Tap'g $ 1,450.
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**#2 Cinc. Tool & Cutter, Universal RBG $ 3,250.

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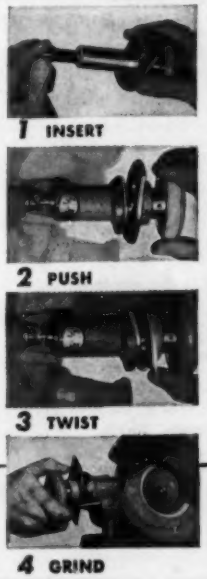

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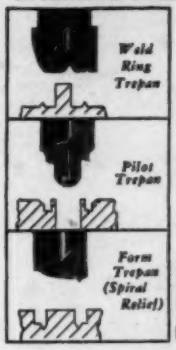

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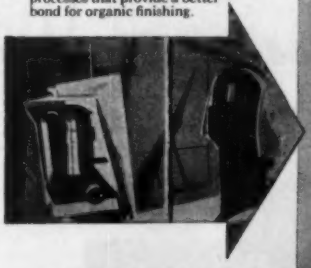

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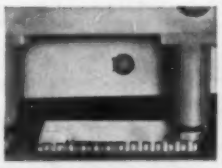

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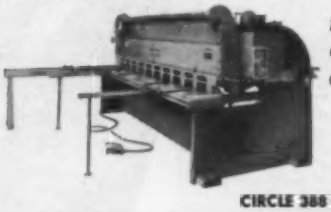

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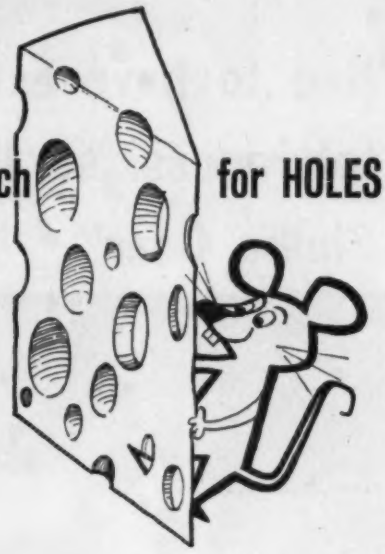

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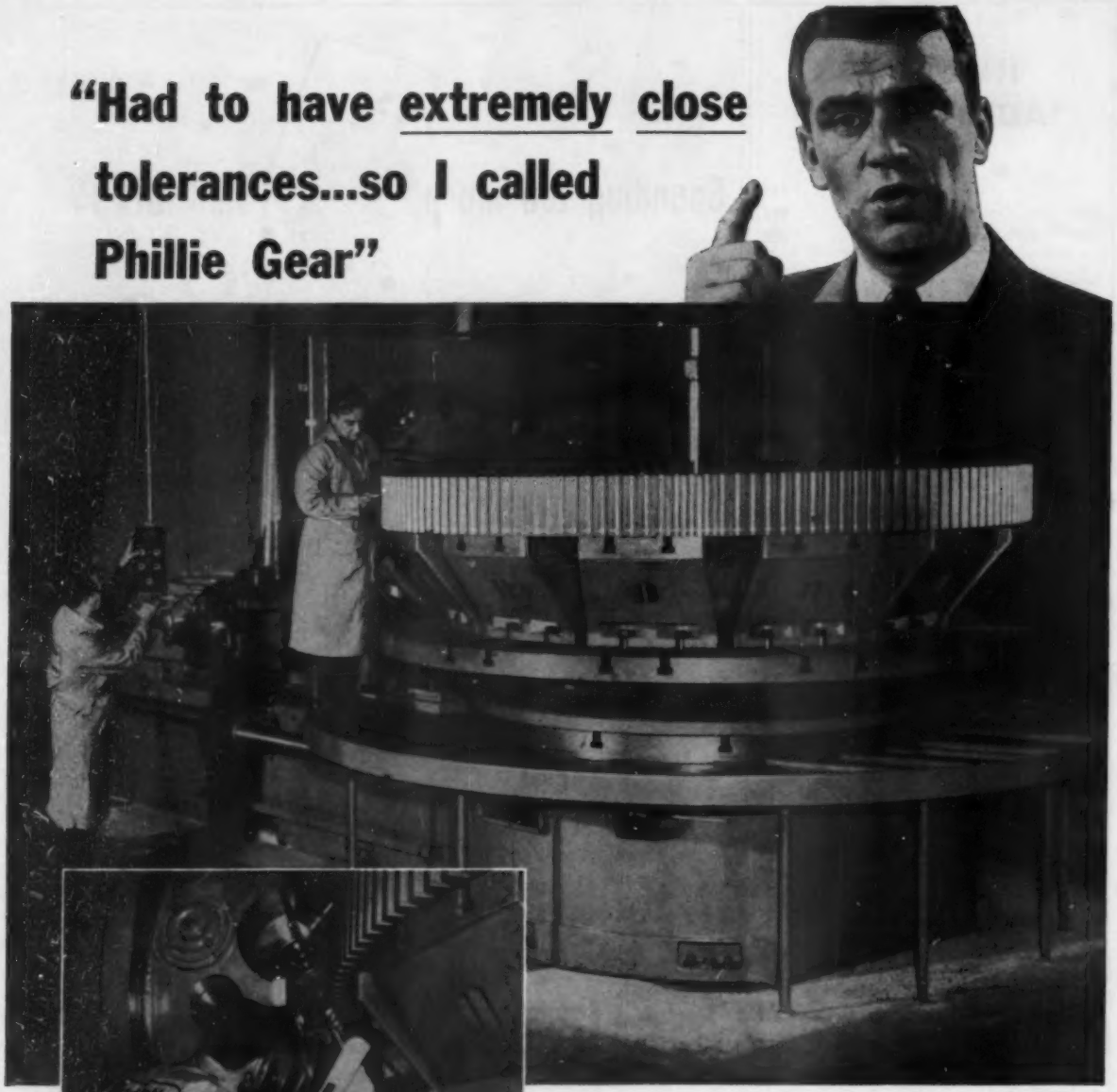

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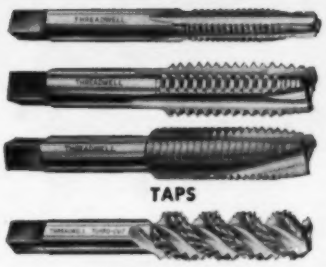

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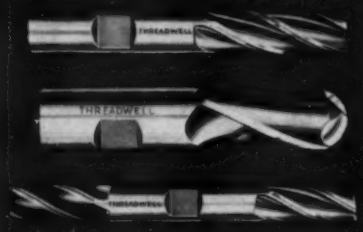

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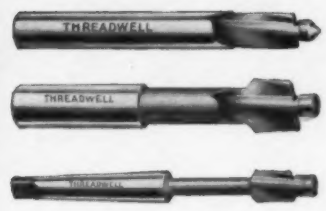

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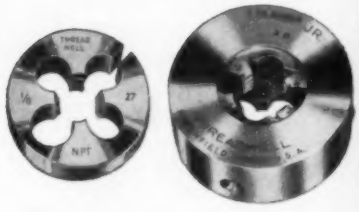

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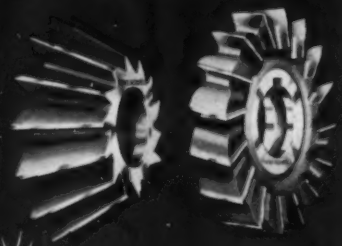

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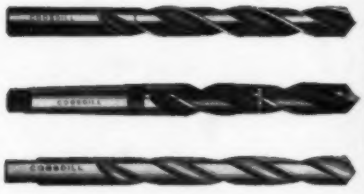

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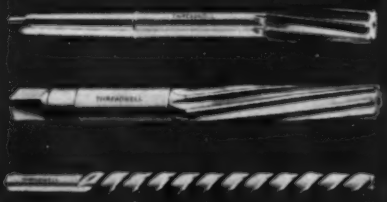

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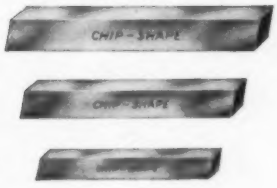

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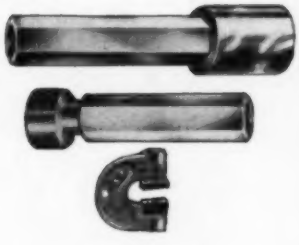

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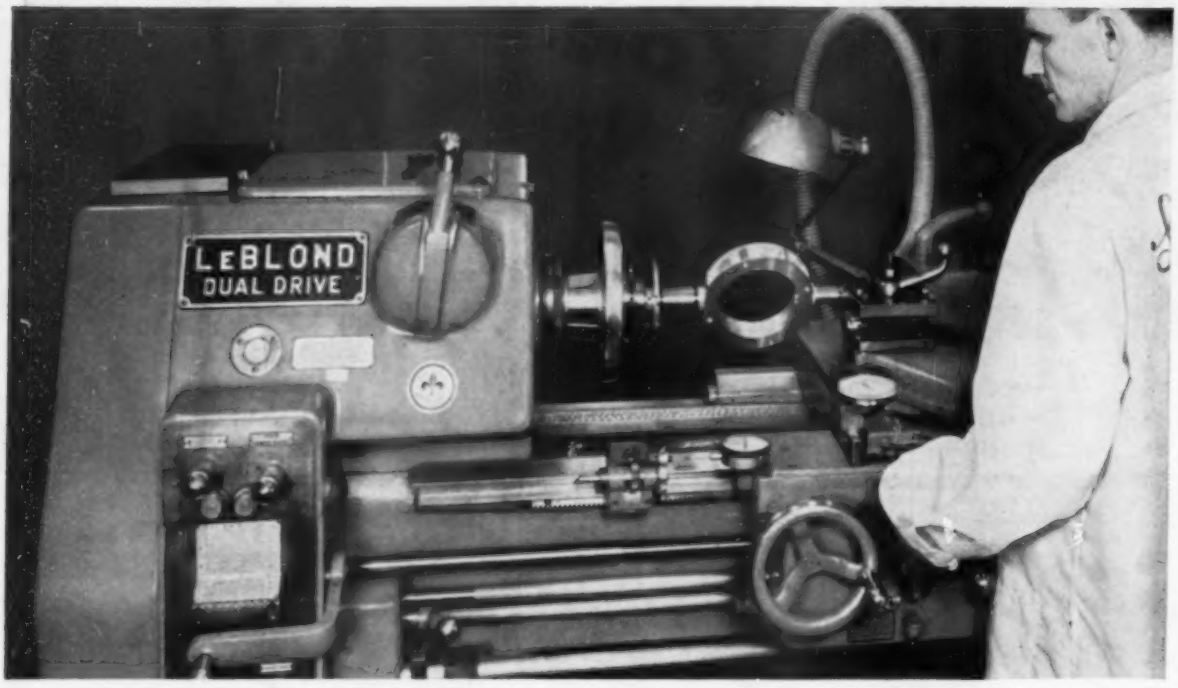

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